Implementation and Evaluation of Biodiversity Conservation Policies in Newfoundland and Labrador, Canada

by

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ABSTRACT

The prevalence and variety of biotic elements, such as flora and fauna and the processes related to them in an environment, may be perceived as a natural occurrence but their sustenance and survival may not entirely be ascribed to natural processes, especially amidst human interactions. Biodiversity loss is a topical issue that has generated concerns over the last few decades leading to the establishment of the United Nations Convention on Biological Diversity (UNCBD) in 1992.

The research aimed to provide a framework for assessment which would contribute towards the reduction of biodiversity loss. The research is empirical in nature and adopted secondary data sources. It examined existing biodiversity management policies, particularly local approaches (coordination and monitoring of biodiversity development management), proposed a local biodiversity information system for monitoring and reporting and identified how best practices in the United Kingdom (UK) can be replicated in Newfoundland and Labrador (NL), Canada. The research objectives include reviewing NL and Canadian biodiversity strategies, investigating local initiatives and actions for effective local policy coordination (biodiversity mainstreaming) and monitoring (biodiversity profiling) performance and developing a local biodiversity information system.

The research identified the main drivers of biodiversity loss, best practices and suggested solutions to biodiversity conservation challenges. The research concluded that the absence of a provincial biodiversity strategy and action plans, the lack of biodiversity policy coordination, monitoring and of a reliable biodiversity information system have resulted in the status and trend of biodiversity loss and inefficient biodiversity conservation in NL.

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AMR	Annual Monitoring Report
BARS	Biodiversity Action Reporting System
BioMAT	Biodiversity Monitoring & Assessment Tool
BISE	Biodiversity Information System for Europe
CARTS	Conservation Areas Reporting and Tracking System
CBD	Convention on Biological Diversity
CBI	City Biodiversity Index
CBIF	Canadian Biodiversity Information Facility
CBS	Canadian Biodiversity Strategy
CEBC	Centre for Evidence Based Conservation
CA	Community Account
CIMS	Community Infrastructure Mapping System
COP	Convention of the Parties
CRB	City and Regional Biodiversity
DEFRA	Department for Environment, Food and Rural Affairs
EMAN	Ecological Monitoring and Assessment Network
EAP	Environmental Action Plan
EIA	Environmental Impact Assessment
ERP	Environmental Review Process
EU	European Union
EU-BS	EU Biodiversity Strategy
EuMon	Europe Monitoring
GEF	Global Environment Facility
GIS	Geographic Information System

GLPI	Global Living Planet Index
IPBES	Intergovernmental Platform on Biodiversity and Ecosystem Services
IUCN	International Union for Conservation of Nature
JNCC	Joint Nature Conservation Committee
LBAP	Local Biodiversity Action Plan
LDF	Local Development Framework
LNR	Local Nature Reserve
LPI	Living Planet Index
LUCAS	Land Use Cover Area Frame Survey
MCA	Marine Conservation Area
MEA	Millennium Ecosystem Assessment
MPA	Marine Protected Area
NBN	National Biodiversity Network
NBSAP	National Biodiversity Strategy and Action Plan
NL	Newfoundland and Labrador
NLBIS	Newfoundland and Labrador Biodiversity Information System
NLC	National Land Cover
NLS-NBF	Newfoundland and Labrador Sub-National Biodiversity Framework
NLS-NBS	Newfoundland and Labrador Sub-National Biodiversity Strategy
NNJPU	North Northamptonshire Joint Planning Unit
NPPF	National Planning Policy Framework
NTPL	National Terrestrial Protected Land
PPS	Planning Policy Statement
RDI	Relative Degradation Impact
RLIs	Red List Indices

RSS	Regional Spatial Strategy
RWIM	Resident Wildlife Information Management
SBPP	Strategic Biodiversity Policies
SCBD	Secretariat of the Convention on Biological Diversity
S-NBS	Sub-National Biodiversity Strategy
SPD	Supplementary Planning Document
SSSI	Site of Special Scientific Interest
TEEB	The Economics of Ecosystems and Biodiversity
TLPI	Terrestrial Living Planet Index
TPL	Terrestrial Protected Land
TRHM	Terrestrial Research and Habitat Management
UK	United Kingdom
UNEP	United Nations Environment Programme
WBM	Wildlife Biodiversity Monitoring
WCMC	World Conservation Monitoring Centre
WIMS	Wildlife Information Management System
WWF	World Wildlife Fund

CHAPTER ONE – INTRODUCTION

1.1 Introduction

The prevalence and variety of biotic elements, such as flora and fauna and the processes related to them in an environment, may be perceived as a natural occurrence but their sustenance and survival may not entirely be ascribed to natural processes, especially amidst human interactions. The drive to ensure sustenance and survival of biodiversity need to meet biodiversity protection targets which has been saddled with challenges at local and global levels (Solon, 1996; Greenfacts, 2016a). Global population-induced needs, such as infrastructure developments (housing, transport and communication networks, industrial development), are important drivers of changes in genetic, species and ecosystem diversity (De Sherbinin, *et. al.* 2007). "With more than half of the world's population now living in urban areas, urban sprawl has also led to the disappearance of many habitats, although the higher population density of cities can also reduce the negative impacts on biodiversity by requiring the direct conversion of less land for human habitation than more dispersed settlements" (Secretariat of the Convention on Biological Diversity, 2010:55).

Biological diversity (biodiversity) is the "measure of the number, variety and variability of living organisms" and comprises "diversity within species" (gene diversity), "between species" (species diversity), and "among ecosystems" (ecosystem diversity) (CBD-UNEP–WCMC *et al*, 2005:4). Mace *et al.* (2014:290) defined biodiversity simply as "species richness" often expressed in functional or ecosystem diversity. Dolman (2000) and Keller and Botkin, (2008) estimated that there are 1.5 million species on Earth. IUCN (2008) observed that the estimated number of species on Earth vary from 5 million to 30 million in existence, Zimmer (2011) observed that there are 8.7million species in the world). Biodiversity has intrinsic value as it is

essential for ecosystem functions and resilience, but it is also perceived to provide vital benefits to humans and life support systems and to provide ecological services, ecosystem services and natural capital that are essential to human well-being, health, livelihoods, and survival (Costanza, *et al.,* 1997; Millennium Ecosystem Assessment (MEA), 2005; TEEB Foundations, 2010; TEEB Synthesis, 2010). The ecosystem, species and gene diversities have been depleted at a higher rate than the natural regeneration process. Eleven studies of marine invertebrates reveal that "fossil species' rate of extinction is 1 to 0.1 *E*/MSY (number of extinctions (*E*) per 10^6 to 10^7 years)" (Pimm *et al*. 1995:347; Rockstrom *et. al,* 2009:473). Furthermore, Rockstrom *et al.* (2009:473) stated that the "extinction rate (number of species per million species per year) is >100" and for mammals, the extinction rate is 0.2 – 0.5 extinctions per million species per year. Biodiversity is one of the four critical boundaries exceeded due to human overexploitation of the ecosystem.

The conservation of biodiversity is crucial amidst competing human needs. Biodiversity loss has adversely contributed to many aspects of human wellbeing, which include food and energy security, susceptibility to natural disasters, access to potable water and raw materials, human health, social integration and freedom of choice.

Biodiversity loss is a topical issue that has generated concern over few decades leading to the establishment of the UNCBD in 1992. This Convention has put the responsibility on party states to prepare national biodiversity strategies to conserve and control the sustainable use of biological diversity and for equitable and fair sharing of the benefits from resource use (McAfee, 1999). In view of this, conscious efforts are needed to address the increasing rate of biodiversity loss at all levels of governance.

1.2 Problem and Purpose Statements

1.2.1 Problem Statement

The management of resources in the environment is becoming increasingly important in recent decades. Recent studies have proved that the prevalence and variety of these resources within systems and localities are inherently different (McCracken and Bignal, 1998; Robinson *et al*. 2005). This scenario is complicated by human induced activities and environmental challenges which stretch the utilisation and carrying capacity of these resources and have created a global decline in biodiversity (Novacek and Cleland, 2001; Brooks *et al*. 2002). Furthermore, this is also reflected in the decline of biodiversity hotspots (Marchese, 2015). Biodiversity hotspot is "a specific location that has enormous species diversity but is also under threat from human activities" (Myers, 1988) and this involves endemism (0.5%) and degree of threat (70% or more).

The current challenges in biodiversity preservation include habitat reduction, habitat fragmentation, over-harvesting, invasive exotic species and pollution (Murray, 2002). These challenges necessitate public intervention in the form of biodiversity management frameworks to meet statutory requirements (goals and targets) amidst the plethora of uncoordinated policies, strategies, plans, etc. (Joint Nature Conservation Committee, 2016a). Biodiversity management policies have been structured at different spatial dimensions largely in the form of strategies, initiatives and actions aimed at local implementation, but these policies, strategies and initiatives often lack proper coordination and monitoring and assessment of performance. Local biodiversity policies implementation is further hindered by lack of adequate funding (Leong, 2009), which is largely ascribed to policy makers' competing priorities and needs. However, the coordination and monitoring of biodiversity policies, strategies,

frameworks and plans are crucial for the success of biodiversity management and policy making process (Tillman, 2000; Najam and Papa, 2006).

Biodiversity management in the UK is guided by different policies, legislation and agreements through different bodies focussed on the environment and its resources. In 1994, a national biodiversity action plan was produced as a commitment to the UNCBD. Due to the devolution of power, individual countries in UK had to produce their independent biodiversity conservation strategies.

The UK has been proactive, innovative and a frontrunner in conserving their biodiversity and in the pursuit of sustainable development and balanced growth (European Union, 2015). The challenges of urbanisation and industrialisation through human interactions with the environment have created enough justification for biodiversity management, hence, the introduction of biodiversity initiatives at different levels of governance to address these challenges.

Despite this history in the UK, little research has been conducted focussing on local biodiversity initiatives and policies (that is, on sustainable local biodiversity management), such as biodiversity development management to coordinate local biodiversity strategies and initiatives and to monitor the performance of these policies, strategies and initiatives in the UK (Robinson *et al*. 2005).

In the same vein, biological diversity management in Canada is led by a national biodiversity strategy (Canadian Biodiversity Strategy - CBS); introduced in 1995, it is Canada's key obligation to the UNCBD. Furthermore, biodiversity management activities are aimed at achieving biodiversity protection goals and targets, while utilising a biodiversity outcome framework to identify, link current and future priorities in planning and implementation (Minister of Supply and Services Canada, 1995). The CBS is implemented through sub-national biodiversity strategies which guide the

conservation and sustainable use of biological diversity and are integrated in sectoral and cross-sectoral plans and programmes at provincial and territorial levels (World Wildlife Fund, 2016). There are jurisdictional (governance) limitations which affirm existing constitutional and legislative responsibilities for biodiversity in Canada (Roberts-Pichette, 1995; Millennium Ecosystem Assessment, 2005; Greenfacts, 2016b). Only five provinces and one territory (New Brunswick, Manitoba, Northwest Territories, Nova Scotia, Ontario and Quebec) in Canada have sub-national biodiversity strategies and action plans, specifically NL province does not have a S-NBS (Biodivcanada, 2015). In the province, the CBS has been combined with "many planning processes which include the development of a provincial sustainable forest management strategy, environmental impact assessment, Ecosystem Status and Trends Assessment and protected areas planning. The Endangered Species and Biodiversity Section of the Wildlife Division implements the strategy within Newfoundland and Labrador" (The Government of Newfoundland and Labrador Province, 2017a: para.3). However, these plans and strategies do not negate the fact that the NL province has no S-NBS which is meant to direct biodiversity conservation approaches in the province.

The absence of a S-NBS in NL province has negative impacts on the conservation and sustainable use of biological diversity and the integration of biological diversity in sectoral and cross-sectoral plans and programmes within the province. However, aside from the jurisdictional limitations, the resultant scenario in NL is not in line with the UNCBD because of lack of local biodiversity and reporting strategies. In addition, there are lapses in the preparation, coordination of biodiversity policies and initiatives and monitoring of performance across all levels of government in NL province.

1.2.2 Purpose Statement

Globally, previous studies have applied a narrative review to identify and discuss human activities in the environment, types and trends of biodiversity loss, roles of different stakeholders, preventive and reactive measures, existing policies, frameworks and conventions and the need for conscious intervention (Loreau, *et al.* 2001: McKinney, 2002; Murray, 2002; Robinson *et al*. 2005). This research proceeds by accepting existing findings such as the loss of biodiversity due to human activities (Naeem, 2002), habitat loss (Federal, Provincial and Territorial Governments of Canada, 2010), differential resilience of ecological systems (Meyer, 2015), limitations in ecological systems' carrying capacity (Naeem, 2002) and systematic restoration of biodiversity (Holt, 2001). This research re-emphasizes the need for effective biodiversity conservation strategies, policies and initiatives and of an efficient management plan for the restoration of biodiversity loss at all administrative levels in NL.

The purpose of this research is to provide a framework for assessment which will contribute towards the reduction of biodiversity loss, to examine existing biodiversity management policies, particularly local approaches (coordination and monitoring of biodiversity development management), to propose a local biodiversity information system for monitoring and reporting and to identify how UK best practices can be replicated in NL, Canada. The research objectives include reviewing NL and CBS, investigating local initiatives and actions for effective local policy coordination (biodiversity mainstreaming) and monitoring (biodiversity profiling) performance and developing a local biodiversity information system. The research will identify best practices and proffer solutions to biodiversity management challenges.

1.3 Thesis Statement

Existing biodiversity monitoring based on narrative review and primary data collection proves inadequate to discuss the conflict between human interaction and biodiversity management goals (Council of Canadian Academies, 2014:27) and does not provide adequate support for public policy intervention (Tillman, 2000; Wardrop and Zammit, 2012). This research starts from the premise that biodiversity loss is a global problem and emphasizes the need for effective coordination and proper monitoring of biodiversity conservation (Tillman, 2000) at the local level. It also proposes the introduction of a real-time local biodiversity information system to address the challenges of local biodiversity implementation in NL, Canada, designed after the model successfully used in other jurisdictions (e.g. UK). The identified knowledge gaps are that existing literature discusses human interaction with biodiversity, and its exploitation (access, use and consumption), and with the environment but does not discuss in a consistent manner, the implementation of local biodiversity protection policies in development plans and policies; and there is no local biodiversity information system to calculate a local biodiversity index in NL, Canada (Wardrop and Zammit, 2012; Council of Canadian Academies, 2014).

1.4 Research Aim and Objectives

This research aims to provide a comprehensive framework to reduce biodiversity loss in NL. The research objectives to achieve this research aim include:

- to assess existing provincial and municipal biodiversity related strategies, policies and plans;
- to examine biodiversity management challenges;

- to investigate the biodiversity policy coordination (mainstreaming) and monitoring (profiling) processes;
- to develop a framework for a local biodiversity information system; and
- to identify policy gaps and recommend best practices from the UK.

This research in more detail assesses existing local (provincial and municipal) biodiversity management policies, assess policy gaps, propose a local biodiversity information system while focussing on the coordination (biodiversity mainstreaming) and monitoring (biodiversity profiling) of biodiversity initiatives in NL province, Canada, and compare them with such strategies/practices existing in UK, with a view to propose the adoption of best practices from UK.

1.5 Research Questions

The research addressed research questions which are focused on the research problems (policy coordination and monitoring) highlighted in the thesis statement. These research questions are as follows:

Research question 1 - *Are there interrelationships between biodiversity policies in NL as compared to UK?*

Data sources to address this question are interrelated policy wordings in biodiversity policies, strategies, plans, regulations and laws at local and national levels in the UK and NL, Canada. The research utilised secondary sourced data which are analysed using descriptive statistics (frequency tables, bar charts and percentages). This research question is focussed on the lack of policy coordination of biodiversity concerns in national and local development framework discussed in the literature review.

Research question 2 - *How well have local biodiversity policies been monitored to achieve their targets?*

The data sources for this research question are the local biodiversity targets, indicators, as included in technical and annual reports on biodiversity initiatives and projects, and the inclusion of biodiversity initiatives in development plans and proposals. Data analysis involved the use of descriptive statistics to compare and assess deviation of the observed from expected biodiversity targets and percentages of achievement and compliance with biodiversity targets. This research question is focussed on monitoring biodiversity policies.

Research question 3 – *how can the current system of biodiversity data collection be improved/made more effective for biodiversity profile of neighbourhoods, towns, cities, municipalities in NL?*

The data sources for this research question are the existing information systems, biodiversity and natural resource observations and existing land use pattern. Data analysis and presentation involved the use of spreadsheet, graphs and maps using Geographic Information System (GIS) to describe the status and trend of biodiversity and identify gaps in the protection of biodiversity and biodiversity hub for data storage. This research question is focussed on the lack of efficient and effective biodiversity conservation information system.

Invariably, these research questions addressed the fundamental research issues (policy coordination and policy monitoring) while providing baseline information for biodiversity information system, basis for local biodiversity policy review and ultimately contributing to the research aim (to reduce biodiversity loss in NL).

1.6 Research Methodology

This research methodology is empirical (Graziano and Raulin, 2004) in nature involving primarily an inductive research mode. It has applied descriptive research design while assessing the biodiversity conservation practice in Canada and introducing best practices from UK. It applied a case study approach (Eisenhardt, 1989; Maton and Salem, 1995) to evaluate biodiversity policies. This research involved interdisciplinary collaboration with "greater coordination from disciplines" (urban and planning, ecology, geographic information system, resource management) from "problem formulation to analysis and interpretation" (Eigenbrode *et al,* 2007). This is considered relevant because the research attempts to describe the prevailing biodiversity policy practices.

This research utilised secondary data sources such as journals, publications, annual monitoring and technical reports by local and municipal governments, statutory and supplementary policy documents and biodiversity information databases. The justifications for using secondary data include research objectives, data availability, appropriateness to research and ethical considerations (Shipley, 2002; Abott, 2009). This research use**d** the purposive sampling technique to select NL province (as a provincial planning unit) and 4 local planning authorities in Northamptonshire Joint Planning Area (a strategic planning unit), North Northamptonshire, UK. The sampling technique is considered appropriate because it is cost effective and "reduces study scope and variability" (Coe, 2008:14). The research utilised both qualitative and quantitative data for descriptive assessment of biodiversity policy coordination (mainstreaming), biodiversity policy monitoring (performance) and to develop the framework for a biodiversity spatial information system (local biodiversity index - profiling). This research evaluate**s** the biodiversity policies, plans and processes, their

linkages and implementation strategies, and addressed the research questions and identified local biodiversity best practices. The research data include the existence of biodiversity policies and initiatives, the agenda for these biodiversity policies, biodiversity policy linkages with other cross-sectional policies across provincial governmental planning levels, measurement of biodiversity indicators, the number and nature of planning permit applications with biodiversity related issues and biodiversity conservation practices.

The research analytical tools used are Microsoft Excel to assess development permit applications and biodiversity management performance level, identify best practices, and biodiversity policy implementation and gaps. Inferences were made from these findings to contribute to developing a framework for a sustainable biodiversity strategy. These research findings also contribute to evidence based biodiversity policy management and recommendations at different levels of policy drafting, implementation and review. Research results will be published and disseminated to enhance existing literature, to share best practices and to guide biodiversity conservation policy-making.

1.7 Knowledge Gaps and Further Research

Recent research examined evaluation of biodiversity policies at local and regional levels, as discussed earlier in this research. Recent studies (Tillman, 2000; Hilbron, *et al.,* 2004; Jones *et al.,* 2007; Diaz and Rosenberg, 2008; and Hilborn, 2016) examined marine biodiversity, while other studies (Ruzzante, *et al.,* 1999; Blaustein, 2010; Darling, 2015; and Laikre, *et al.,* 2016) examined genetic biodiversity and focused on resource conservation and protection. However, these previous studies did not examine ecosystem biodiversity from policy evaluation and implementation

perspectives. Furthermore, previous research did not focus on investigating biodiversity policy coordination and monitoring, development permit application processes and performance, and identifying biodiversity best practices as challenges of local biodiversity policy implementation in NL. This research provided insights into local biodiversity conservation in the UK to adopt best practices in NL. The areas for further research include developing a City and Regional Biodiversity (CRB) index to assess biodiversity initiatives, projects and internalising the cost of biodiversity policy implementation for community identity and belonging.

1.8 Ethical Considerations

This research fostered high research quality and integrity through conscious observation, analysis and presentation of results and findings. This research utilises secondary data, therefore, there is little or no human contact and concerns for ethical issues such as researcher interaction with respondents, seeking informed consent, respecting the confidentiality and anonymity of research respondents. Lastly, the researcher can demonstrate the ability to conduct ethically appropriate research by having completed the MUN's ethics online course.

However, there are potential outcomes and implications of this research such as Governments' reluctance to change the status quo, Governments' intention to respond and act in the nearest future and the decision to initiate action and implement recommendations. Germane to these, are potential policy implications which include the review of the biodiversity issues in the province, contributing to the preparation of provincial biodiversity strategies in accordance with the national and international biodiversity frameworks and the integration of biodiversity mainstreaming at all levels

of governance to achieve coordinated, monitored and spatially documented biodiversity strategies.

1.9 Expected Contributions

The research findings are expected to assess existing biodiversity policies to enhance their coordination and performance level and to contribute to the preparation and implementation of local and provincial biodiversity policies and strategies. The research identified biodiversity policy gaps and encouraged adoption of best practices in biodiversity management from the UK. The research findings aim to contribute and expand the frontiers of knowledge and support established findings.

1.10 Dissemination Plan

This research intends to disseminate research results and findings through established platforms such as Memorial University of Newfoundland Library's thesis repository and publish in peer reviewed journals and publications. Copies of the thesis will be deposited in the sampled joint planning authority (4 local planning authorities) in the UK and the Theses Canada Program where it will be catalogued, preserved and made accessible to the public.

CHAPTER TWO - LITERATURE REVIEW

2.1 Literature Review

2.1.1 Definition of Biodiversity

"Earth's ecosystems have evolved for millions of years. This process has resulted in diverse and complex biological communities, living in balance with their environment. These diverse ecosystems also provide people with food, fresh water, clean air, energy, medicine and recreation. Over the past 100 years, however, nature and the services it provides to humanity have come under increasing risk" (World Wildlife Fund, 2016:10). The resultant diversion in the complex biological communities has been described as biological diversity (biodiversity) which has been lost gradually.

This literature review focuses on biodiversity, biodiversity protection, the frameworks for assessment of biodiversity loss or conservation, the key threats and need to address biodiversity loss at the local level but with a global perspective. It includes the review of any biodiversity strategy in the province of NL. This review defines biodiversity, explores the development of a provincial biodiversity strategies, policy and plans, the challenges of local biodiversity conservation, the implementation of adaptive biodiversity management (coordination and monitoring) and identifies policy gaps.

Biodiversity has been defined and described in different manners and contexts. Lovejoy (1980) described biodiversity as the number of species. Dodson *et al.*, (1998) defined biodiversity as ''the abundance, variety, and genetic constitution of native animals and plants''. Thus, biodiversity is "a contraction of biological diversity, generally refers to the number, variety and variability of living organisms" (Greenfacts, 2016b). Millennium Ecosystem Assessment (2005:18) and Convention on Biological

Diversity (1992a) described biodiversity as **"**the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems**".** Furthermore, Environment Canada (nbd:2) defined biodiversity as "the variety of species and ecosystems on earth and the ecological processes of which they are a part".

Variability may be explained as the measure of variation within and between ecosystem, genes and species. This is important in biodiversity because it underlines richness in species and genes and stability (resilience) which are the bedrock of biodiversity hotspots. There are three basic components of biodiversity which are "ecosystem, species and genetic diversity" (Minister of Supply and Services Canada, 1995:4). Hence, biodiversity is the variety of life, in all of its manifestations." (BioMAT, nbd; para.1). Although there are commonalities in these definitions in terms of the taxonomy and context, they differ in terms of implementation approach and scope (geographic scale and sectoral).

The implications of different understandings of the concept of biodiversity create unclear scientific findings and their inherent policy implications. Therefore, every component (species, genetic and ecosystem) of biodiversity requires clear understanding and consideration for policy making processes, management goals and policies. "Biodiversity has taken centre stage in the planning and strategy of environmental and conservation bodies throughout the world. The term incorporates biological, geographical and human attributes which deserve some explanation before considering how biodiversity can be conserved" (Murray, 2002:5).

Biodiversity has been on the global agenda since mid-1980's for diagnosis and to proffer solutions to identified biodiversity challenges. The United Nations' Agenda 21

acknowledged that the world's biodiversity is decreasing regardless of conscious efforts to address it. The main drivers are deforestation, over-exploitation of natural resources and environmental pollution which resulted in habitat loss and extinctions (terrestrial, freshwater and marine). This has led to the Convention on Biological Diversity (CBD) being prepared and signed at the Rio Summit in 1992 (Stakeholder Forum for a Sustainable Future, 2012).

2.1.2 Local Biodiversity Goals, Strategies, Policies and Plans

The knowledge and understanding of the Anthropocene era, described as a geological epoch which needs a paradigm shift in global environmental governance (Barry and Maslin, 2016), requires conscious efforts to address biodiversity loss and related issues by using an adaptive approach (Eddy *et. al.,* 2014). The philosophical underpinning is to think globally and act locally (Costanza *et al*., 2007) which attempts to articulate biodiversity loss globally and recommends implementation of biodiversity conservation locally, while considering human impacts on the environment. While articulating climate change started at the global level and defined responsibilities for nation states, protection of biodiversity started at the national level (establishment of national parks and nature reserves in USA in the 19th century) and moved later to the international level, after the 2nd World War (Rosendal and Schei, 2012). There is general consensus and direction at the global level with regard to biodiversity loss (Secretariat of the Convention on Biological Diversity, 2010; Stakeholder Forum for a Sustainable Future, 2012; Greenfacts, 2016b and World Wildlife Fund, 2016). However, there are different perceptions and responses to local conception and approaches reflecting prevailing factors (Costanza *et al*., 2007; Sörlin and Warde, 2009; Stakeholder Forum for a Sustainable Future, 2012:103). Invariably, these

differential local contents set the basis for varied approaches and solutions to biodiversity loss.

The establishment of the UNCBD in 1992 initiated the global agenda setting for biodiversity loss reduction, based on the precautionary principle. The overarching goals are to conserve and control the sustainable use of biological diversity and the equitable and fair sharing of the benefits from resource use (McAfee, 1999). Every member state was to prepare national strategies in pursuit of these goals. At the Convention of the Parties (COP10) in Nagoya (2010), the parties to the CBD agreed on the so-called Aichi Biodiversity Targets - by 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced (Secretariat for Convention on Biological Diversity and the United Nations Environment Programme, 2012; UNEP, 2012). CBD lacks a common procedure for producing "certified knowledge" like that of the climate regime (Vatn, 2015:248). However, national strategies were prepared to direct local biodiversity strategies, policies and plans to achieve the global biodiversity goals.

In Canada, biodiversity management is topical and current because of the country's "natural wealth which is the envy of many nations and is supported by a strong tradition of conservation and sustainable use. An important component of this wealth is Canada's biodiversity – the variety of genes, species and ecosystems and the ecological processes that allow them to evolve and adapt to a changing world" (Minister of Environment and Climate Change, 2016a:4). "Canada's boreal forest is home to 85 species of mammals, 130 species of fish, some 32,000 species of insects, and 300 species of birds. The largest area of wetlands in any ecosystem of the world is found in the Canadian boreal region, containing more lakes and rivers than any

similarly sized landmass on earth" (Treehugger, 2011:5,27). "Canada's ecological footprint is 7.66 in hectares per person, the percentage of Canadian land (mostly) untouched by human activity is 82% and Canada accounts for 24% of global wild forests, 20% of global fresh water and 24% of global wetlands" (TheBigWild, n.d.). However, it is important to note that Canada's ecological footprint is huge compared to the global average of 2.87 global ha/person. Canada can afford such a high ecological footprint due to the high bio-capacity, which includes biodiversity, measured in 2012 at 4.3 gha/capita (Stechbart and Wilson, 2010).

The structure for biodiversity management in Canada is pivoted on the Canadian Biodiversity Strategy (1995) which was developed to meet a key obligation of the Convention on Biological Diversity. This strategy aims to encourage intergovernmental collaboration to improve the "policy, management and research conditions" required for "ecological management" and pursue the implementation of the directions in accordance with the Canadian Biodiversity Strategy in their "policies, plans, priorities and fiscal capabilities". It contains series of "guiding principles that provide the foundation for implementing its strategic directions" (Minister of Supply and Services Canada 1995:3). The key issue is the extent to which this national strategy is able to permeate to the local levels (province, territorial and municipal) due to jurisdictional limitations (Roberts-Pichette, 1995; Millennium Ecosystem Assessment, 2005; Greenfacts, 2016b),

Billard (1998) in a study focused on Marine Protected Areas (MPAs) and their evolution to Marine Conservation Areas (MCAs) in Newfoundland, revealed the biodiversity implications of MPAs on the sea bed, surface of the water and living resources within the environment. The study, using secondary data sources, further highlighted that the compatibility of economic benefits and biological goals largely

depends on an effective management structure including enforcement measures (monitoring) and public education. The study emphasized the need for resource management through the designation of areas for protection of resources in order to boost economic benefits in the long run. However, the study did not state the bases, criteria and requirements for this designation which could guide best practice and replicability.

The UN 2020 targets for protection of 17% land (Terrestrial Protected Area - TPA) and 10% coastal and MPAs as contained in Aichi Target 11 of the CBD are yet to be met. As at 2015, "10.6% (1.05 million km^2) of Canada's terrestrial area (land and freshwater), and 0.9% (51 thousand km^2) of its marine territory have been recognized as protected" (Environment and Climate Change Canada, 2017a: para1). The percentage of land and fresh water (terrestrial) protected area in NL is "7.3% - 29,420km^2" (Environment and Climate Change Canada, 2017b: para1), while the percentage of MPAs in NL (Newfoundland -Labrador Shelves) is less than 0.5%.

Vatn (2015) emphasized the immense contribution of protected areas to biodiversity preservation, as compared to other alternatives such as sustainable use of protected areas (Juffe-Bignoli *et. al.,* 2014), payment for ecosystem services (Wunder *et. al.,* 2008), biodiversity offsets with habitat banking (Madsen *et. al.* 2010). These alternatives present forms of money compensation for biodiversity loss.

Tillman (2000), in a related research, examined ocean policy development in Canada and other marine nations (Australia, India, United States of America and Japan) in historical perspective, while highlighting challenges and opportunities. The research used secondary data sources to discuss policy instruments in Canadian Coastal and Ocean Management, the importance and contributions of natural resources (biodiversity) to Canada and the people. The research concluded that

effective and functional coordination of these policies is crucial and requires a great deal of commitment for successful implementation of a local biodiversity protection plan. However, the research focused exclusively on the ocean ecosystem and did not address terrestrial and marine ecosystems. This may result in a disjointed incremental approach to biodiversity management.

Other studies refer to conscious public interventions at the provincial and territorial levels to address biodiversity loss. “Most provinces have developed new or revised land-use policies and planning acts that emphasize ecosystem-wide approaches. British Columbia was a pioneer in this area: by 2008, approximately 85 percent of the province was covered by 26 strategic land-use plans” (Government of Canada, nbd:12). These public interventions include the British Columbia’s Central Coast and North Coast Land and Resource Management Plan, Biodiversity BC and New Brunswick’s biodiversity strategy. Other “provincial and territorial governments, including Saskatchewan, Ontario, Québec, New-Brunswick, and the Northwest Territories”, have formulated or are in the process of formulating their sub-national biodiversity strategies and action plans (Government of Canada, nbd:4).

These differences in biodiversity management developmental stages across Canada have created huge gaps in the pursuit of and meeting of national biodiversity goals and targets, which further impede Canada’s obligations towards the CBD.

The New Brunswick’s biodiversity strategy crystallised an outcome based framework to promote a “coordinated and collaborative approach to the conservation and sustainable use of biological resources, representing a significant evolutionary step forward”. A biodiversity action plan evolved thus and “the leadership and coordination structure” created “a biodiversity secretariat, an interdepartmental implementation committee and a deputy minister biodiversity steering committee” and

current effort was put into articulating the “best path forward to develop an action plan” (Government of Canada, nbd:2). It is observed that this strategy was steered towards meeting the goals of the biodiversity strategy but the success of the leadership and coordination structure is critical to this research and there is no statistical evidence to confirm this.

However, regardless of the availability or lack of local biodiversity strategies, policies and plans (like in NL, for instance), there are still jurisdictional lapses (policy, plans and processes) both institutional and operational (Roberts-Pichette, 1995; Minister of Supply and Services Canada, 1995; Millennium Ecosystem Assessment, 2005; Greenfacts, 2016b) in biodiversity management in Canada.

2.1.3 Challenges of Biodiversity Conservation

There has been an increase in size and intensity of the “human enterprise in exponential rate since the mid-20th century” and this consequently led to a “transition from Holocene to Anthropocene” (Waters *et al.,* 2016:1526), a geological epoch which presented dramatic climatic change, oceans acidification and biomes loss at an unprecedented rate. This scenario constitutes a risk that the Earth will become much less hospitable to our modern globalized society (Richardson *et al*., 2011; World Wildlife Fund, 2016:10). Researchers are attempting to determine which human-induced changes pose the greatest threat to our planet’s resilience (Costanza *et al*., 2007; Rockström *et al.,* 2009a; Rockström *et al*., 2015).

These studies emphasized the paradigm shift from the Holocene to the Anthropocene perspective of human impact on natural resource. This transition does not provide a clear framework to apply in order to overcome challenges and achieve the biodiversity goals.

The most prevailing challenge to biodiversity is the loss and degradation of habitat which has been identified by these studies (Baillie *et al.*, 2010; Böhm *et al.*, 2013; IUCN, 2015, IUCN, 2015a and WWF, 2016) as the main threat to vertebrate species. However, the principal causes of habitat loss are unsustainable agriculture and logging, and changes to freshwater systems (Baillie *et al.*, 2010). Threats often interact to exacerbate the effects on the environment. For example, habitat destruction and overexploitation might compromise a natural resource's ability to respond to changes in climate (Costanza *et al*., 2007; Dirzo *et al.*, 2014 and World Wildlife Fund, 2016).

The human-induced loss and degradation of habitat is quite critical and signifies the extent of potential loss and damage during the Anthropocene era. This is exacerbated by increased urbanisation needs and finite natural resources to meet these needs. This emphasized the need for the assessment of human-induced impacts (ecological footprint) and the Earth's capacity (biocapacity) to cope.

The Earth's biocapacity indicates that humanity requires the "regenerative capacity of 1.6 Earths" to meet annual global demand for goods and services (World Wildlife Fund, 2016:13). Furthermore, the developed countries account for a higher per capita ecological footprint than developing countries (Global Footprint Network, 2016). However, there are intra-regional differences in human-induced impacts (ecological footprint) in these categories of countries which are dependent on availability of natural resource, rate of resource use and resource restoration efforts. Canada has an ecological footprint of 7.66 in hectares per person (TheBigWild, n.d.) which makes it a creditor country due to its size and wealth of ecological amenities.

Canada's landscape is "353.5 million km^2 (60%) forests and 70% of this is boreal forest". There are relatively different human impacts, where the "southern boreal forest" has been much more "fragmented by human impacts" due to Canada's

demography (most of Canada's 35 million inhabitants live in the geographical South). Canada's forest is lost annually to other types of land cover by "0.01 to 0.02%". There is transition of old forests to young forests in some areas but "Newfoundland and Labrador's boreal forest and British Columbia's coastal rainforest" are 40% old forests (Federal, Provincial and Territorial Governments of Canada, 2010:2).

The global environmental conditions of the planet reflect the extent of the impacts of these threats on the natural environment. The Living Planet Index (LPI - an indicator of the state of global biological diversity, based on trends in vertebrate populations of species from around the world calculated by the WWF) has been used to represent biodiversity loss. The most recent Living Planet Report (2016) shows that "The LPI indicates a 58% decline between 1970 and 2012, while freshwater environment has the greatest losses; there may be an average decline of 67% in vertebrate populations from 1970 by 2020 if the present trend continues and there is increasing risk of water and food insecurity and competition over natural resources due to increased human pressure. Furthermore, these increased and persistent human impacts on the planet have put vital environmental systems at the risk of climate change, biosphere integrity, biochemical flows and land system change. The direct implication of this scenario is that by 2012, the equivalent of 1.6 Earths was needed to provide for the natural resources and services humanity consumed in one year" (World Wildlife Fund, 2016:15). There is need for conscious effort to address increasing risks, and the management approach is crucial to deliver expected results. This method of assessing human impacts provides means of monitoring impacts, the extent of damage but there are differences in the degree of human-induced impacts and resultant biodiversity loss (Klinke and Renn, 2002).

The possibility of threats and challenges depends on ecosystem, species and genes' resilience, location and the types of the challenge (Collen *et al.,* 2011; Pearson *et al.,* 2014). These threats and challenges require public intervention in the form of biodiversity management, means to meet statutory requirements (goals and targets) amidst the plethora of uncoordinated policies, strategies, plans etc. (Joint Nature Conservation Committee, 2016a). Many of these challenges are linked to human interaction with the environment. Invariably, these are resultant effects on the environment while reflecting the system's carrying capacity and its limitations. Similarly, the United Nations targets, developed to terminate "the loss of biodiversity are designed to be achieved by 2020; but by then species populations may have declined on average by 67 per cent over the last half-century" (World Wildlife Fund, 2016:12)

In recent decades, since the Agenda 21 was adopted, there has been a paradigm shift from a narrow perspective of "conservation towards a more inclusive" and responsive approach reflecting "ecological, socioeconomic and governance" considerations coupled with "increasingly complex policy processes" (Stakeholder Forum for a Sustainable Future, 2012:103). The main threats to biodiversity include environmental degradation, foreign species invasion, natural resource depletion, climate change and aquatic environment disruption (Wanjui, 2013; Ontario Biodiversity Council, 2016).

It is evident that economic and industrial development, agriculture expansion and deforestation (often illegal) thrived at the expense of ecosystems loss (Abramovitz, 1998; Rands *et al.,* 2010). In addition to this, genetic diversity of crops and livestock is declining and plants and organisms are at the threshold of extinction (Secretariat of the Convention on Biological Diversity, 2010). Germane to this, 25% of plant species

are susceptible to extinction and the rate of extinction for warm water corals and amphibians is on rapid increase (Secretariat of the Convention on Biological Diversity, 2010). The loss of biological diversity is not experienced evenly in many sectors, economies and environments. Nonetheless, developed nations are identifying significant improvements in their biological diversity due to increased and conscious environmental awareness and effective coordinated and responsive policies (Taylor, *et al.,* 2012).

It is necessary to consider these challenges from a sustainable development perspective in order to have a broad knowledge and diagnosis of the challenges posed. Recent decades have exhibited a dual challenge – to manage nature and its functions and to provide an "equitable home" for people on a limited planet – earth. The dual challenges are highlighted in the "UN 2030 Agenda for Sustainable Development". The principal "economic, social and ecological dimensions" of sustainable development are "interconnected" and must be approached in an "integrated manner" (World Wildlife Fund, 2016:106).

Furthermore, land use conversion from forest, grassland and other habitats to agricultural and urbanized area with their resultant loss of habitat accounts for reduction in biodiversity (Erisman *et al*., 2013). The limit for "human changes to land systems" should not be only quantifiable but in terms of "function, quality and spatial distribution" (Steffen *et al,* 2015a cited in World Wildlife Fund, 2016:68).

Recent studies have revealed that uncoordinated policies (Tillman, 2000:35; Stakeholder Forum for a Sustainable Future, 2012:101) and improper monitoring (Millennium Ecosystem Assessment, 2005:69) are two major challenges to local biodiversity policy implementation (Millennium Ecosystem Assessment, 2005:13). Germane to this, "the success in addressing these challenges depends largely on

creating coherent and realistic policies and enabling sound governance" (Stakeholder Forum for a Sustainable Future, 2012). This research will explore existing knowledge about uncoordinated policies and improper monitoring as mitigating factors to local biodiversity policy implementation in NL.

2.1.4 Policy Coordination in Local Biodiversity Management

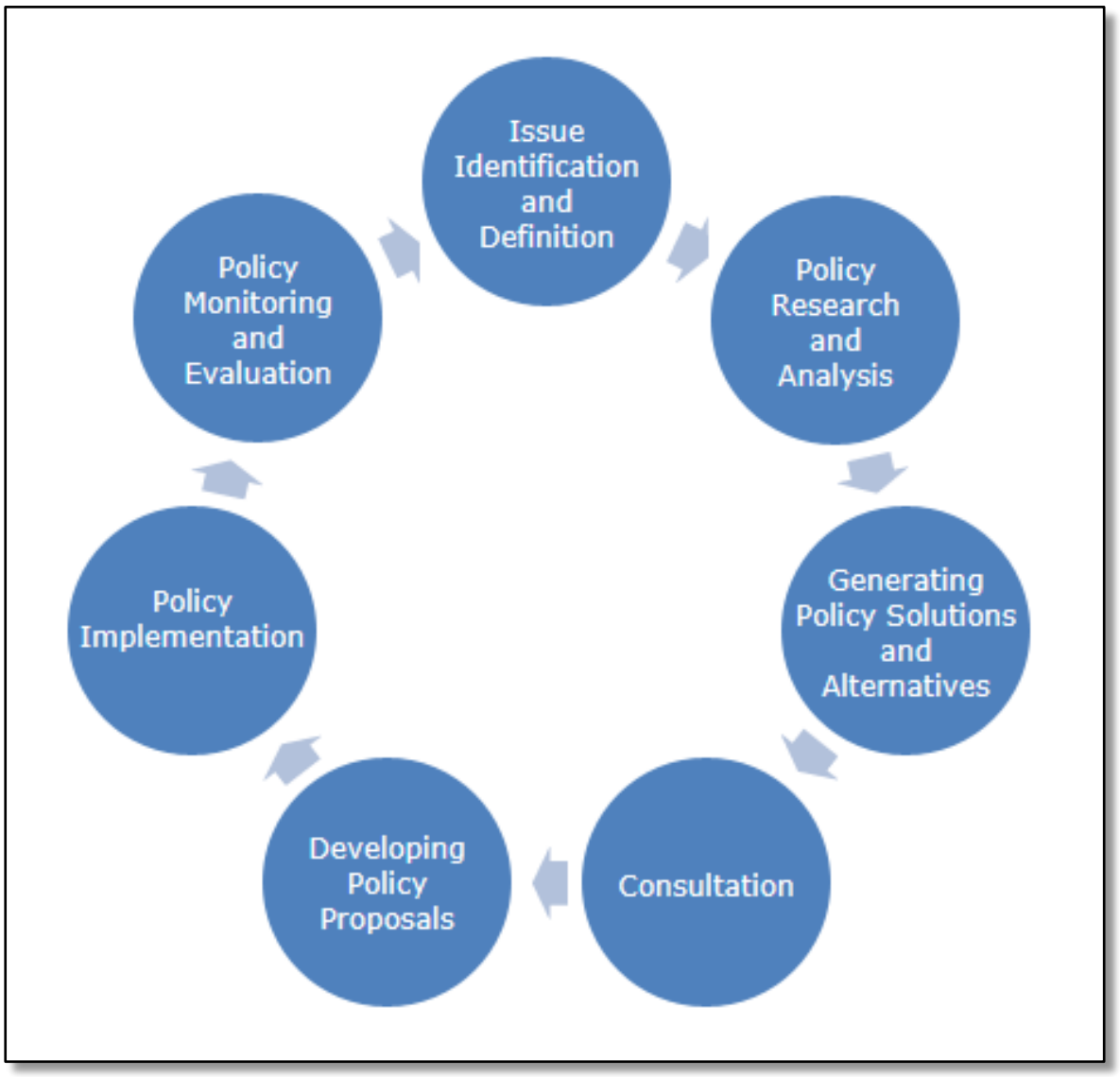
Policy is defined as "a course of action or inaction rather than a specific decision or action" (Heelo, 1979 cited in Rosenbaum, 2011:36). Similarly, "a policy is a plan of action to guide decisions and actions based on a set of preferences and choices" (Maetz and Balie, 2008:3) which usually involve a defined vision. Policies are sets of guidelines formulated or adopted towards a set of goals or objectives, they are usually made public and accessible. Policies and procedures are often drafted to influence decisions, actions, outcomes and related activities. Procedures are the specific means applied to implement the policies on a daily basis. Invariably, policies and procedures aim to integrate steps of actions to achieve policy objectives and outcomes. The integration of steps of actions in policy decision making processes is perceived as policy coordination.

Policy coordination is better understood from the policy cycle perspective (Maetz and Balie, 2008:3). A policy cycle is initiated by the agenda setting phase - lobbying issue on government priority list for consideration and response. The formulation and legitimation phase involves setting goals and objectives, generating alternatives and selection of preferred alternative. Legitimisation is through political institutions to get public acceptance. This is considered the weak aspect of this phase because of limited public acceptance. Then, the implementation phase - operationalising public policy which is determinant on its impacts and bureaucratic structure. Policy assessment

phase involves assessing the social impacts, its desirability and communicating the results to the government and the public. Policy reformulation is the result of continual monitoring and assessment of the impacts of public policy. Termination phase is the conclusive and successful completion of governmental agenda - plans, programs, policies or organisation (Jann and Wegrich, 2007; Maetz and Balie, 2008; Rosenbaum, 2011; Knoepfel *et al.* 2011; Kraft, 2016). The policy cycle is graphically represented in Figure 2.1 below. This shows that sequence of actions in the policy cycle from issues identification and agenda setting to policy monitoring and evaluation as discussed above.

Policy instruments are tools used by governments to influence individuals, communities and organisations' preferences for expected outcomes. Policy instruments are often procedural in nature and focus on the decision-making processes rather than on changing individuals' or firms' behaviour (Howlett, 2002; Winfield, 2014a). However, deep structural and economy-wide behavioural changes require an integrated regime with a combination of different instruments (Rosenbaum, 2011). From this premise, addressing the challenges of local biodiversity management implementation requires a combination of policies (goals, strategies, actions, plans etc.) which need to be coordinated to achieve better, pre-determined targets and outcomes.

Figure 2.1 – Policy Cycle



Source: The Government of Newfoundland and Labrador (2017g), The Policy Cycle, Policy NL, Retrieved on the 30th May 2017 from http://www.policynl.ca/policydevelopment/policycycle.html

Suffice to say at this juncture that successful implementation of local biodiversity policies requires systematic, responsive and tact coordination of a set of actions (strategies, policies, methods, etc.). Recent studies revealed that policy coordination (integration) in different disciplines have been ignored (Millennium Ecosystem Assessment, 2005:16; Winfield, 2016b). These studies supported the need for policy coordination. However, cross-sectoral policy coordination (mainstreaming) will be

much more efficient and beneficial to local biodiversity management because it introduces biodiversity concerns in the policy of other sectors (extraction of raw materials – mining, fishing and agriculture, manufacturing and services) and diminishing average total cost of human-induced impacts by expanding the scale of operations. Biodiversity mainstreaming means “integrating or including actions related to conservation and sustainable use of biodiversity in strategies relating to production sectors, such as agriculture, fisheries, forestry, tourism and mining” (GEF, UNEP and CBD, 2007)

Tillman (2000) postulated that the opportunities the marine environment offers (economic, socio-cultural and recreational) have influenced Canada’s identity, history and growth. The research observed that these opportunities have led to congestion, environmental degradation and ecosystem imbalance. As a result, the survival of marine ecosystems is at risk and requires policy integration and multi-sectoral consideration (mainstreaming). Tillman (2000) also observed that long term implications and cross-sectorial influences of policies and initiatives are often not considered.

In the latest Living Planet report, World Wildlife Fund (2016:106) postulated that “we must minimize climate change while securing our future freshwater supply; and we should protect forests and grasslands as well as our oceans and atmosphere. Modification of any of these interconnected facets of the biosphere can affect the others, thereby altering the biosphere as a whole. An integrated approach for managing our biosphere will improve social stability, economic prosperity and individual well-being. We are not going to develop a just and prosperous future, nor defeat poverty and improve health, in a weakened or destroyed natural environment.” The report observed that the UN Global Goals for Sustainable Development will be

challenging to achieve if the status quo persists. There has been deviation from meeting the UN biodiversity targets to eliminate biodiversity loss by 2020 and development strategies, economic models, business models and lifestyle choices need to be synchronised in the future (World Wildlife Fund, 2016).

In the same vein, forests play a pivotal role in the interplay between land use and climate and are the determinant for the land-system change boundary (Steffen *et al*., 2015a; Snyder et al., 2004). Steffen *et al*. (2015a) indicated that the boundary for land-system change has been exceeded. Furthermore, in terms of integration of biodiversity management policies, the Millennium Ecosystem Assessment (2005:11) argued that substantial gains accrue from better integration of ex-situ and in-situ conservation strategies, including sectoral responses and coordination among and between multilateral environmental agreements and institutions and biodiversity conservation and development planning frameworks.

Tillman (2000) conducted an assessment using the Rio Declaration on Environment and Development's 27 principles as a framework to identify the principles to be included in ocean policy and to rank the impact of the presence or absence of biodiversity as a principle among six other principles in policy wordings of the current coastal zone and ocean policy. The assessment revealed the "absence of biodiversity among six other principles and has had negative impact on aquatic resources" (Tillman, 2000:49). At least 50% of the respondents indicated that biodiversity was their highest ranked principle that was absent in the policy wordings (Tillman, 2000). This assessment investigated how well coordinated biodiversity policies are within the existing ocean development policy. However, the extent of the cross-sectoral coordination of biodiversity management policies at the local level within existing development planning framework was not discussed.

It is worthy to note that different human-induced impacts such as large-scale agriculture (cattle rearing), or overfishing often transcend across sectors and borders (national and regional) from the points of origin. Furthermore, the interconnectivity between actors, plans, processes, causes and scale makes biodiversity loss challenging to address" (World Wildlife Fund, 2016:13).

The successful implementation of a local biodiversity strategy will be dependent on the extent to which all sectors adopt the local biodiversity's vision and principles and are engaged towards the achievement of its goals. Consequently, the conservation of biodiversity and the sustainable use of biological resources will need active collaboration and engagement of "individual citizens, local and indigenous communities, urban and regional governments, conservation groups, business and industry, and educational and research institutions" (Minister of Supply and Services Canada,1995:3). A proposed mechanism for implementing the Canadian Biodiversity Strategy is to coordinate the local, sub-national, national and international elements of the Canadian Biodiversity Strategy (Minister of Supply and Services Canada,1995).

In addition to these, policy coordination is enshrined as an overarching 2020 biodiversity goal for Canada which include that "by 2020, Canada's lands and waters are planned and managed using an ecosystem approach to support biodiversity conservation outcomes at local, regional and national scales" (Minister of Environment and Climate Change, 2016:6). This position is further substantiated that federal, provincial and territorial governments in Canada agreed to new medium-term goals and targets to achieve long-term biodiversity outcomes which require collective participation of actors in both public and private sectors whose actions and decisions affect biodiversity. All governments and sectors are required to actively contribute (Minister of Environment and Climate Change, 2016:2).

Further evidence of mainstreaming biodiversity is contained in the Greening Government Action Plan (2015 - 2019) which aims to create “a culture of environmental sustainability within the Government of Newfoundland and Labrador” (Office of Climate Change and Energy Efficiency, 2015:4). This Action Plan is prepared based on specific objectives and action dates towards the procurement of goods and services, waste diversion, buildings, transportation and employee engagement while focusing on sustainability, innovation and collaboration. This Action Plan emphasized policy coordination through two guiding principles (collaboration and integration) and mid-term review of the Action Plan.

In the light of the collaboration and integration guiding principles in the Greening Government Action Plan (2015 - 2019), some projects were identified to contribute towards Environment Canada’s Strategic Outcomes. These projects include the Central Labrador Environmental Action Network, Labrador Southeast Coastal Action Program, Humber Arm Environmental Association and Northeast Avalon Coastal Action Plan.

Studies (Tillman, 2000; Rosenbaum, 2011; Winfield, 2016b; World Wildlife Fund, 2016) have established the need for cross-sectoral policy coordination for local biodiversity management. However, these studies did not address the policy coordination of terrestrial ecosystem management through sub-national biodiversity strategies, development plan proposals and policies and responsive local biodiversity information system to monitor the achievement of goals and targets. Invariably, effective local biodiversity policy implementation would require responsive policy monitoring in addition to efficient policy coordination.

2.1.5 Policy Monitoring in Local Biodiversity Management

Policy implementation and evaluation are crucial stages in the policy cycle aimed towards the success of the entire policy making process. Policy implementation also requires responsive evaluation (monitoring) to ensure policy outcomes are achieved (Maetz and Balie, 2008; Rosenbaum, 2011; Kraft, 2016). This research discusses assessment as a means of monitoring local biodiversity policies, initiatives and their effectiveness. It discusses local biodiversity policy monitoring through the lens of assessing policy performance and developing a responsive information system.

Monitoring may be described as a continuous evaluative process from initiation to implementation to completion. Monitoring and evaluation are also the basic means of assessing whether a plan or project meets its targets and objectives (Global Environment Division – World Bank, 1998). Monitoring and evaluation may also mean "the identification and assessment of threats and problems in a manner that allows managers to respond effectively – (this) is a central component of good conservation management" (Sheil, 2001).

Hence, biodiversity monitoring is the "repeated observation or measurement of biological diversity to determine its status and trend" (BioMAT, n.d. para.1). Biodiversity monitoring is further defined as "the systematic and focused observation and measurement of present changes of biodiversity in its various forms (genes, taxa, structures, functions, ecosystems) usually within a defined context e.g. a research question or a management goal" (Juergens, n.d).

Noss (1990:1) observed that "biodiversity is presently a minor consideration in environmental policy because it is quite broad and vague a concept to be applied to real-world regulatory and management problems". The research discussed three primary attributes of biodiversity – "composition, structure, and function" in a four-level

organisational structure – “regional landscape, community-ecosystem, population-species, and genetic”. The research focused on terrestrial ecosystems and identified indicators of these attributes for environmental monitoring purposes. The research applied a top-down, coarse-scale assessment of “landscape pattern, vegetation, habitat structure, and species distributions” with rigorous research and monitoring applied to “high-risk ecosystem and elements of biodiversity”, while less rigorous monitoring was applied to the total landscape (Noss, 1990:2).

Biodiversity monitoring uses limited indicators due to biodiversity complexity, inadequate taxonomy and the cost of biodiversity assessments. These indicators may be qualitative (presence or absence of an indicator) or quantitative (number, density, distribution of indicators in the habitat) (BioMAT, n.d.). Juergens (n.d.) observed that assessing recent biodiversity changes provides baseline information for understanding system properties and dynamics with four basic goals – measurement of the direction and speed of present change, identifying external forces responsible for observed change, understanding the mechanisms and processes, and to enable future prediction. The approaches to biodiversity monitoring may include “neutral observation (what happens?), early warning system (when must we take action?), indicators of biodiversity change (what is important?), causality (why does change happen?), process analysis (how does change happen?), model-based approach (do we understand the full picture?) and experimental approach (how can we intervene?)” (Juergens, n.d.).

Biodiversity monitoring can have direct relevance to policy making – either as baseline information to inform the policy making process, or to meet scientific interests and to define feasible political efforts towards conservation and sustainable development of biodiversity (Juergens, n.d.). Biodiversity monitoring is an obligatory

responsibility in The Convention on Biological Diversity which obliges each signatory Member State to “as far as possible and as appropriate, to identify components of biological diversity important for its conservation and sustainable use ..., to monitor, through sampling and other techniques, the components of biological diversity identified..., as well as to identify processes and categories of activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of biological diversity, and monitor their effects through sampling and other techniques (Article 7)” (BioMAT, n.d. para.4).

Biodiversity monitoring differs depending on its scale, type, indicators and scope (BioMAT, n.d.; Juergens, n.d.; Roberts-Pichette, 1995). Biodiversity monitoring at the global level and within international research programs involves “dealing with global environmental change and monitoring of the change of biodiversity” which have recently increased in global attention (Juergens, n.d.).

Biodiversity monitoring in terms of scope, is explicitly embedded in several policy documents which include the “European Environmental Action Plan, the European Biodiversity Strategy, and the 2010 target of halting the loss of biodiversity. Member States are legally bound by the Habitats and Birds Directives to monitor biodiversity” (BioMAT, n.d. para.5).

The EU-wide monitoring (EuMon) project is a policy support project with applied methods and systems of surveillance to monitor two main components of biodiversity: species and habitats. Different properties of these components of biodiversity were monitored which included “trends in populations, distribution, community composition, habitat quality etc”. This method collected data on the “presence/absence, counts, updated data, population composition, phenology and other measures”. However, the

BioMAT tool provides support for the design and analysis of biodiversity monitoring" (BioMAT, n.d. para.6).

A study of the Mediterranean Basin (Europe) revealed that the "abandonment of traditional land-use practices has been reported as one of the main causes of decline for open-habitat species. Data from large-scale bird and butterfly monitoring schemes in the north-east Iberian Peninsula were used to evaluate the impact that abandonment of traditional land-use practices has had on local biodiversity. The patterns shown by indicators were in line with the changes occurring in forest cover in the monitoring sites. This study reveals that multi-species indicators based on monitoring data from different taxonomic groups (birds and butterflies) may usefully be employed to track impacts of environmental change on biodiversity" (Herrando *et. al.,* 2015).

In 2001, the European Council agreed to "halt biodiversity loss by 2010" (regarded as Agenda 2010) and conduct regular assessment of biodiversity which was necessary to inform the political process. Thus, monitoring is a fundamental tool which provides answers to decision makers' questions and includes "coordination and standardization of biodiversity monitoring across Europe; efficient and effective spending of the limited resources available for monitoring; and more regular and integrated reporting of monitoring results" (Henle, n.d.). Apart from the commitment to achieve Agenda 2010, there is uncertainty about how to monitor biodiversity and the assurance of meeting the targets. Policymakers need to be assured of the "effectiveness of policies and their implementations to protect and use biodiversity in a sustainable manner to aid decision making and public access to the assessments." (Henle, n.d.).

In view of the above scenario in Europe, it is necessary to discuss biodiversity monitoring practices in the UK. The UK signed an agreement under the CBD and consequently aims to achieve the biodiversity goals and targets “the Aichi targets – 2010, by 2020, at least 17% of terrestrial and inland water, and 10% of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascapes and set out in the Strategic Plan for Biodiversity 2011-2020”). This involves developing and using a “set of indicators to monitor and report on progress towards meeting these international goals and targets” (Joint Nature Conservation Committee, 2016b).

In the UK, the responsibility for the environment and biodiversity lies principally at the country level. The specific elements of biodiversity are addressed independently in collaboration with other countries (England, Scotland, Wales and Northern Ireland) in the UK. The UK Biodiversity Strategy objectives are to “halt the loss of biodiversity; increase awareness, understanding and enjoyment of biodiversity; restore and enhance biodiversity through better planning, design and practice; development of an effective management framework; and ensure knowledge on biodiversity is available to all policy makers and practitioners” (Joint Nature Conservation Committee, 2016c).

The UK Biodiversity Strategy is implemented using the UK Biodiversity Framework which is prepared to identify the activities to aid the achievement of the UK member country’s strategies, “in pursuit of the Aichi targets”. Therefore, the framework is prepared, directed and implemented by each country in the UK, assisted and coordinated by Department for Environment, Food and Rural Affairs - Defra and Joint

Nature Conservation Committee - JNCC (JNCC and Defra, 2012:1). Consequently, there are differences (in details and approach) in the strategies, but they are based on the same principles and attempt same global targets. The common categories in these strategies are “international/European context, facilitating and contributing to common country approaches and solutions, evidence provision and reporting” (JNCC and Defra, 2012:2).

The UK Government published the Planning Policy Statement (PPS) 9 – Biodiversity and Geological Conservation which stipulates the Government’s national policies on the protection of biodiversity and geological conservation through the planning system. The PPS9 provides non-technical and non-scientific advice which is based on key principles which require planning policies and decisions to “avoid, mitigate or compensate for harm” and seeks means of enhancing and restoring biodiversity and geology (Office of the Deputy Prime Minister, 2006:2). In addition, the PPS9 contained provisions that enhance addressing biodiversity through the Regional Spatial Strategies (RSS) and the Local Development Framework (LDF). This is the fundamental basis for the preparation and implementation of the local biodiversity policies and action plans across the UK.

A study of the criteria used in biodiversity loss monitoring surveys while using secondary data sources (UK farmland bird data) stated that “no single index” can reveal all elements of biodiversity change (Bucklands *et al*., 2005:1). In a research aimed at developing a list and order by priority the attributes of biodiversity monitoring programme in the UK, a collaborative approach was applied to develop a list of 25 attributes of “biodiversity monitoring schemes”. This research involved 52 experts in biodiversity monitoring who ordered these attributes from most elemental (such as articulate the objectives and gain sufficient participants) to most aspirational (for

instance, electronic data capture in the field, reporting change annually) to assist in prioritizing resources to develop biodiversity monitoring programmes (Pocock, *et al.* 2015).

The Global Environment Division – World Bank (1998) utilised a monitoring and evaluation plan to monitor implementation performance and project impacts on the status and trends of biodiversity. The research by the World Bank adopted a descriptive assessment method to monitor implementation performance of biodiversity policies in the UK while focussing on habitat loss, threat levels and land use change. However, this research will apply a descriptive assessment of the integration and monitoring of local biodiversity policy implementation. In the same vein, this research on local biodiversity policy management will utilise descriptive case study assessment to monitor policy performance.

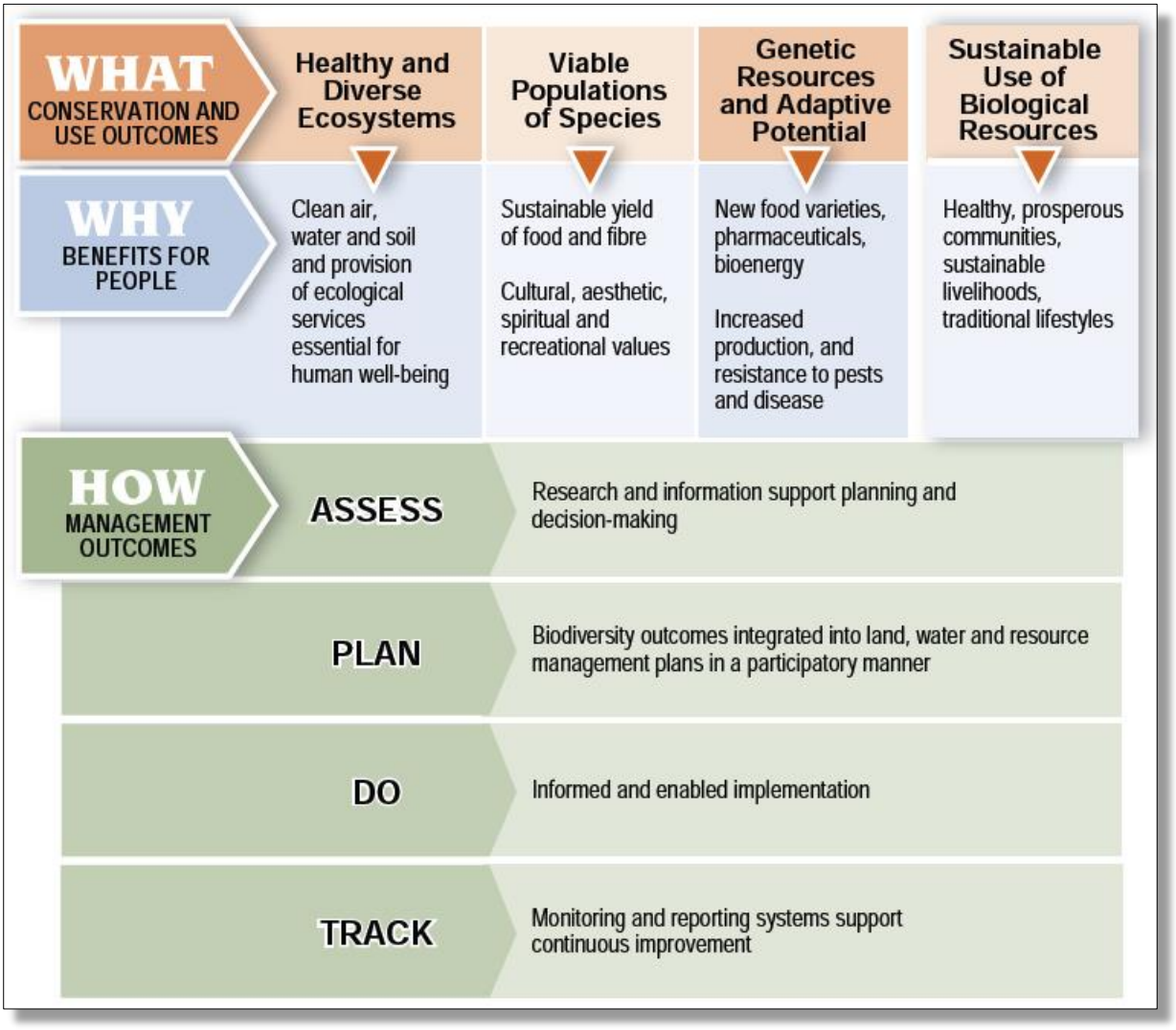
In Canada, the biodiversity conservation policy uses a top-down and ecosystem-based approach stemming from the Federal level to other jurisdictional levels (Roberts-Pichette, 1995; Minister of Supply and Services Canada, 1995; Millennium Ecosystem Assessment, 2005; Greenfacts, 2016b). Historically, for more than ten years, these (federal, provincial and territorial) governments have been collaborating to sustain Canada's biodiversity. They collectively develop a blueprint for the “sustainable use and conservation of Canada's natural resources”. This blueprint is called Canadian Biodiversity Strategy and currently only five provinces and one territory have drafted their biodiversity strategies. (Biodivcanada, 2015: para.5).

The national biodiversity strategy has five broad goals – “sustainable conservation of biodiversity and use of biological resources; improve the understanding of ecosystems and increase resource management capacity; promote an understanding of the need for sustainable conservation of biodiversity and use of biological

resources; develop incentives and legislation that support sustainable conservation of biodiversity and use of biological resources; and collaborate with other countries for sustainable conservation of biodiversity and use of biological resources and equitable share of benefits from the utilization of genetic resources" (Minister of Supply and Services Canada, 1995:2). In addition to coordinating the implementation of national and international elements of the strategy by the Federal and Provincial Governments, one of the proposed mechanisms for implementing the CBS is reporting (monitoring) the status and trend of biodiversity. Operationally, the CBS is implemented through various sub-national biodiversity strategies at provincial and territorial levels. Achieving the national biodiversity strategy is crystallized on the biodiversity outcomes framework which stipulates the steps and activities to achieve the aims and objectives of the national biodiversity strategy (Minister of Supply and Services Canada, 1995), as shown in Figure 2.1 below.

The Canadian biodiversity outcomes framework is developed to complement, advance, identify and connect "current and future priorities, to engage Canadians in planning and implementation and to report on progress" (Biodivcanada, 2015: para.5). The Canadian biodiversity outcomes framework highlights and guides progress towards Canada's Biodiversity Outcomes. The Canadian biodiversity outcomes framework gathers information and coordinates efforts to assess, plan, and track biodiversity related activities and initiatives in collaboration with government agencies and non-government partners in Canada" (Government of Canada, nbd:4), as shown in Figure 2.2 below.

Figure 2.2 – Canadian Biodiversity Outcomes Framework



Long Description for the Biodiversity Outcomes Framework: Focus on "Why" "What" "How"
Source: *Government of Canada (nbd) "Caring for Canada's Biodiversity – highlights of Canada's 4th National Report to the Convention on Biological Diversity, Government of Canada, p.4* (http://www.biodivcanada.ca/default.asp?lang=En&n=F14D37B9-1 para.5.

A practical application of the Canadian biodiversity framework was in a research in 1996 by Independent World Commission to understand the ocean development policy design and development process. The Independent World Commission on the Ocean conducted a regional assessment of the public perception of ocean's management policy and practice. The assessment utilised both primary and secondary data sources. It assessed the "perceptions of marine pollution sources, principles and

values in Canada's ocean policy, current practice in sustainable ocean development and analysis of ocean community attributes" (Tillman, 2000:47). At least 50% of the respondents indicated that the absence of the biodiversity principle as means of assessing the effectiveness of the policy had negative impacts on ocean resources and policy development. This result influenced the inclusion of biodiversity considerations in ocean development policy. However, there is a need to ascertain the precise trend and status of biodiversity loss across Canada. This includes Canada's rate of deforestation which accounts for "0.4% of global deforestation" (Natural Resources Canada, 2008: para.4). The number of species of tree per hectare is 450 for the tropical rain forest of Brazil, while it is 180 for all of Canada (International Conservation Fund of Canada, 2017). In addition, 10.6% (1.05 million km2) of Canada's terrestrial area (land and freshwater), and 0.9% (51 thousand km2) of its marine territory have been recognized as protected as of 2015.

The Government of Canada (Natural Resources Canada) monitored biodiversity with earth observation data through BioSpace (a joint project of the Canadian Forest Service, Canadian Space Agency and the University of British Columbia Satellite). BioSpace applied the remote sensing technique to gather data on four landscape characteristics ("topography, productivity, land cover and disturbance") to monitor biodiversity on a national scale. The spatial-temporal monitoring of landscape characteristics provided a potential early warning system identifying where the critical threats to biodiversity are and attention should be directed (Natural Resources Canada, 2016). This may be in the form of biodiversity hotspots or areas of greatest biodiversity threats.

In the light of this, Wanjui (2013) applied two biodiversity assessment methods (in-situ and ex-situ biodiversity conservation) to assess biodiversity and plan for different

biodiversity conservation approaches. He concluded that ex-situ conservation involves the “conservation of biological diversity outside of their natural habitats” and it is crucial in “recovery programmes for endangered species” (Wanjui, 2013:2). It provides a good platform for research opportunities on the components of biological diversity. He stated that in-situ biodiversity assessment for conservation is focused on conservation of species within the natural environment and is the most appropriate method of assessment for biodiversity conservation because of the ease of creating a high biodiversity area and closeness to natural habitat (Wanjui, 2013).

The Millennium Ecosystem Assessment Report (2005) applied an assessment of biodiversity responses (changes in biodiversity in response to change or disturbance) while placing human well-being as the central focus for assessment, recognizing that people make decisions concerning ecosystems based on a range of values related to well-being, plus values of biodiversity and ecosystems. The assessment viewed biodiversity responses as “means of assessing values at different scales, with strong links to ecosystem service values and well-being arising at each of these scales. The well-being of local people dominates the assessment of many responses (Millennium Ecosystem Assessment” (2005:69).

Stanford University (2016) observed that the protected natural land constitutes about 13 percent of the world's land area. Majority of the earth’s species are found in “ecological gray areas”, located within a continuum of pristine wilderness and parking lot. The protection of these species in such ecological areas is increasingly challenging due to the “time-consuming field survey” to assess biodiversity. Invariably, decision making for habitat and species protection is challenging. Researchers at Stanford have developed a technique to assess biodiversity through detailed assessment, charting and study based on tree cover. The findings of the research are relevant to

policymakers in their effort to “protect biodiversity and endangered species” (Stanford University, 2016: para.2).

Butchart *et al*., (2010:1) observed that “most indicators of the state of biodiversity (covering species’ population trends, extinction risk, habitat extent and condition, and community composition) showed declines, with no significant recent reductions in rate, whereas indicators of pressures on biodiversity (including resource consumption, invasive alien species, nitrogen pollution, overexploitation, and climate change impacts) showed increases. Despite some local successes and increasing responses (including extent and biodiversity coverage of protected areas, sustainable forest management, policy responses to invasive alien species, and biodiversity-related aid), the rate of biodiversity loss does not appear to be slowing” (Butchart *et al.,* 2010:1).

Similar conclusions appear in a study of species’ threat status and trends using the World Conservation Union (IUCN) Red List Indices (RLIs). The “Red List Indices (RLIs) demonstrates the rate of species change in the overall threat status (i.e. projected relative extinction-risk), based on population and range size and trends as quantified by Red List categories. The study utilised information from a high proportion of species worldwide and revealed that the world’s bird species show that their overall threat status has deteriorated during the years (1988-2004) in all biogeographic realms and ecosystems” (Butchart *et al*., 2005:1).

Furthermore, while focussing on biodiversity standards and certification to assess performance, an assessment by the United Nations Environment Programme (UNEP) reviewed the biodiversity safeguards contained within 36 standards (“to protect biodiversity, limit threats to biodiversity and promote biodiversity enhancement”) and certification schemes, drawn from eight business sectors (such as agriculture, biotrade, carbon offset, finance, fisheries, forestry, mining, and tourism), and

concluded that there is a great deal of variation between standards with regard to the coverage of biodiversity, definitions used, and the measures adopted for biodiversity protection (UNEP-WCMC & SCBD, 2011:7).

This research has discussed various approaches to biodiversity monitoring (reporting) highlighting different mechanisms, methods and foci at different levels but identified that there are commonalities in terms of the status and trend of biodiversity. The current research will apply a descriptive assessment of biodiversity policies in order to measure the achievement of local biodiversity conservation within the scope of the national biodiversity strategy and the biodiversity outcomes framework. However, this approach will be hampered by lack of knowledge of vital primary data biodiversity information. Therefore, there is a dire need for a responsive biodiversity information system to record changes, progress and achievement at the local and provincial levels.

2.1.6 Local Biodiversity Information Management Systems

The proper understanding and articulation of issues in the policy cycle (from agenda setting to evaluation) requires responsive, reliable and relevant evidence-based data to foster policy decision making. Policymaking is a dynamic and continuous process; policymakers are controlled by political processes and institutions; environmental policymaking is a controversial mixture of politics and science; science tends to legitimate policy, regardless of differences in decision making polity. On this premise, political institutions have not been factual, truthful and responsive to the public by suppressing, for ideological reasons mostly, scientific findings and hard evidence

revealing potential threats from environmental challenges - climate change, ozone layer depletion, habitat loss etc. (Rosenbaum, 2011).

As a result, more public participation in advancing and applying scientific knowledge is encouraged and refers to the dynamic interplay between science, expert knowledge and citizens in democratic settings. Readjusting scientific expertise in a more civic manner stems from citizen participation in production, validation and application of scientific knowledge. This ensures a sound evidence base and ultimately contributes to meet the biodiversity strategy objectives of integrating activities and monitoring the status and trend of biodiversity conservation (Bäckstrand, 2003).

A significant challenge to biodiversity conservation is the inadequacy of knowledge of the array of the existing biodiversity. The number of species that exist on Earth has been estimated as 1.5million (Keller and Botkin, 2008; Dolman (2000), varying from 5million to 30 million (IUCN, 2008) and 8.7million (Zimmer, 2011). This is in addition to new species discovered annually and new groups located. However, little is known about the ecosystem functions and their response to changes (Rands, *et al.*, 2010). In addition to lack of scientific information, there is an overall lack of awareness of the importance of biodiversity among policy-makers and the wider public. Policymakers commonly undervalue biodiversity when formulating government policies in areas such as agriculture, fisheries, and industry (Secretariat of the Convention on Biological Diversity, 2010). The lack of adequate knowledge and awareness can be address by information presented in different forms such as maps, survey results, scientific journals, databases, websites etc. The important issue here is the relevance and applicability of the information to the policy cycle and how it contributes to biodiversity management and conservation.

Halpern, *et al.,* (2008) prepared a global map of human impacts on marine ecosystem using an additive model. They concluded that “the management and conservation” of the earth’s oceans need the integration of geodata on the “distribution and intensity of human activities” and the extent of their effects on “marine ecosystems”. “An ecosystem-specific, multiscale spatial model” was developed to integrate 17 universal data sets of “anthropogenic drivers of ecological change for 20 marine ecosystems”. The resulting analytical model and maps enhanced “conservation resource allocation, implementation of ecosystem-based management; and informed marine spatial planning, education and basic research” (Halpern, 2008:948).

Due to the need for issue specific and high volume data for biodiversity decision making, Kelling *et al.,* (2009) applied data-intensive science as a new paradigm for biodiversity studies. Data-intensive science (Newman *et al*., 2003) takes a “data-driven” approach in which information evolves from the data, instead of the traditional “knowledge-driven” approach.

Recent studies (Newman *et al*., 2003; Rands, *et al.*, 2010) demonstrated the need for the development of mega data and their application in scientific analysis. The goal was to create cross-sectoral data regularity and storage strategies to make scientific data available. There was more focus on the cyberinfrastructure required to create and provide access to big data than on how the creation and control of data will affect scientific processes (Kelling *et al.,* 2009).

The need for large volume databases witnessed the introduction of the “Global Living Planet Index” (GLPI) which measures biodiversity by collecting data of vertebrate species and assessing an “average change in abundance over time” (World Wildlife Fund, 2016:18), while the “Terrestrial Living Planet Index” (TLPI) involves the

assessment of many habitats and manmade environments to populate the databases (World Wildlife Fund, 2016:22). These databases allow for better articulation of the patterns behind population decline on local or global levels. The databases recognize five categories of threats – “habitat loss and degradation, species overexploitation, pollution, invasive species and disease and climate change” (World Wildlife Fund, 2016:22).

The European Commission (2017), in an attempt to contribute to avert biodiversity loss in 2020, developed policy directions on nature and biodiversity through enacting nature and biodiversity laws, species protection, green infrastructure, Natura 2000, knowledge, data collection and analysis. The European Commission observed that “effective policymaking for biodiversity and ecosystem services relies on continuous research and innovation” and aims to advance the biodiversity knowledge base by building and informing policy with current scientific data and information. The Biodiversity Information System for Europe (BISE), which contributes to the enhancement of the knowledge and evidence base for the EU’s environmental policy, became the main interface for biodiversity data and information sharing (European Commission, 2017). However, in practice, the EU 2010 biodiversity baseline and updated EU biodiversity indicators and other networked databases such as the “Shared Environmental Information System and Global Monitoring for Environment and Security, the European Forest Data Centre and the LUCAS – Land Use Cover Area Frame Survey” (European Commission, 2017: para.3) were the key sources of information.

Similarly, Henle (n.d.) developed a European Monitoring (EuMon) database to coordinate and order biodiversity monitoring, effective and efficient resource utilization for monitoring, and for regular and integrated dissemination of monitoring results in

Europe. This monitoring scheme (EuMon) focused on existing monitoring schemes, methods and approaches suitable for monitoring species and habitats, and methods for systematic reserve site selection and identification of gaps in the Natura 2000 network (Henle, n.d.).

Chape, *et al.* (2005) in a study developed a database of the "numerical, spatial and geographic attributes of protected areas". This study was enhanced by the examination of the biodiversity coverage of these protected areas while applying "species, habitats or biogeographic classifications". The study concluded that "conservation effectiveness indicators" need to be considered in the database to "enhance the value of protected areas data as an indicator for meeting global biodiversity targets" (Chape, *et al*. 2005:4). The goal is to assess the level of achievement of conservation initiatives using databases and information analysis as the base for decision making.

DEFRA (2007:13) argued that "there is need to develop innovative cost-effective methods for surveillance of species and habitats and continue to develop innovative methods for sharing information for managers and policy makers through the National Biodiversity Network (NBN), Local Record Centres and Biodiversity Action Reporting System (BARS); to accumulate and share knowledge more effectively through initiatives like the Centre for Evidence Based Conservation (CEBC); to maintain taxonomic expertise and develop new methods of identification; and to explore new policy options".

The Government of Canada established the Canadian Biodiversity Information Facility (CBIF) in 2003 to enhance the efforts of the Global Biodiversity Information Facility (GBIF) and to explore innovative means of organising, exchanging, analysing and disseminating primary data on biological species of interest. This enhances

access to information and provides a useful resource that enables social and economic decisions to “conserve our biodiversity, sustainable use of biological resources and monitor and control pests and disease” (Government of Canada, 2015a: para.1).

Similarly, Canadensys is a Canada-wide database on biodiversity information held in biological collections and publicly accessible. Canadensys’ aim was to “collect, digitize, publish and georeference 3 million specimens (20% of the global species), through a network of compatible databases like “the Canadian Biodiversity Information Facility - CBIF and the Global Biodiversity Information Facility – GBIF”. The current structure of the Canadensys’ network consists of over 11 participating universities, five botanical gardens, and two museums, with over 13 million specimens. Canadensys is a dynamic, central web portal which enables access to the network’s species-occurence geospatial data. Canadensys implements cross-analyses of species’ geospatial and environmental data and enhances the “understanding of global environmental issues and the development of sound biodiversity policies” in Canada (Canadensys, n.d.).

A biodiversity information system is a vital information tool that could be used to store, analyse and present data to inform decision-making processes. This information system could be updated to provide specific information such as a diversity index to assist the understanding and knowledge of the trend and status of biodiversity loss.

A diversity index is a “mathematical measure of species’ diversity in a community. Diversity indices provide more information about community composition than simply species richness (i.e., the number of species present); they also take the relative abundances of different species into account” (Hurlbert, 1971; Beals, *et al.* 2000; Barcelona Field Studies Centre, 2017). It is also a statistic used to approximate the

diversity of a set of species, in which each species belongs to a classic group (National Institute of Standards and Technology, 2016).

Lahde *et al.* (1999) applied an ecosystem index to examine the abundance of tree species and variation in tree size, age and genetic composition which was used to generate the list of threatened species and categorize their habitat needs in the National Forest. This research aimed to “develop a mathematically formulated within-stand diversity model and create a diversity level classification” (Lahde *et al*. 1999:214).

Similarly, Wessels, *et al.* (2004) used vegetation index data to assess the effects of human-induced land degradation in northern South Africa. This research used the National Land Cover (NLC) data from Landsat Thematic Mapper imagery to calculate the Relative Degradation Impact (RDI). The research observed that the RDI, spanning the “land capability units”, varied from “1% to 20% with an average of 9%”. The research concluded that there has not been severe “reduction in ecosystem function within the degraded areas” but the RDI indicated a “reduction in productivity” (Wessels, *et al*, 2004:54).

Chu *et al.* (2011) in a study of the comparative regional assessment of impacts on freshwater fish biodiversity offered in-depth assessment of freshwater fish species biodiversity as regards environmental and stress metrics across Canada. “Species presence-absence data were used to assess richness and rarity indices. An environmental index was assessed using growing degree-days above 5^0C, elevation range within the watershed, mean annual sunshine hours, and mean annual vapour pressure. Conservation priority rankings were developed for the watersheds using an integrative index of the three indices. The study concluded that Southern Ontario and

British Columbia watersheds were rated high because they contained the greatest biodiversity and the most stress" (Chu, *et al.* 2011:626-628).

A City Biodiversity Index (CBI) was developed by the Secretariat of the Convention on Biological Diversity (SCBD) in 2010 as a self-assessment tool to enhance the "roles of cities and local authorities to implement the national biodiversity strategies and action plans (NBSAPs)". CBI was aimed at gauging biodiversity conservation efforts and committing to reducing the rate of biodiversity loss. CBI consist of three aspects - "native biodiversity, the ecosystem services provided by native biodiversity, and the governance and management of native biodiversity". The ecological footprint of cities, differential extinction of species, differential land use features in built-up areas and many more concerns were considered in selecting the indicators. 23 indicators were selected from these three aspects and each of the indicators have a score of four. The CBI is a fluid process, mathematically robust, focused on biodiversity, varied and extensive, self-assessed with potential for building databases and involved a range of experts and stakeholders. However, the CBI is deficient because of the difficulty of selecting universal indicators with available data, and scoring difficulty due to different ecozones. Moreover, the lack of knowledge makes ecosystem services indicators difficult to design (https://www.cbd.int/authorities/doc/User's%20Manual-for-the-City-Biodiversity-Index18April2012.pdf).

In summary, the existing literature on biodiversity has discussed the main challenges of local biodiversity management in Europe, UK and Canada and emphasized and highlighted the current trends and status of biodiversity and how biodiversity loss can be averted by 2020. Researches have confirmed that the "loss of habitat has been the main threat to biodiversity loss in Canada". In respect to the focus

of this research, this would be examined from the terrestrial ecosystem perspective" (Federal, Provincial and Territorial Governments of Canada, 2010:14).

This literature review observed that little has been said about the policy gaps such as absence of the local and sub-national biodiversity strategies in NL, uncoordinated biodiversity policies, improper monitoring and inadequate and non-responsive local biodiversity information system in NL. In the light of these, the research gaps include the lack of sufficient knowledge about the interplay between urban and regional planning processes (development permit process, land sub-division policies, urban and regional development policies and information system) and biodiversity considerations in many policy decision-making processes, while focussing on ecosystem (habitat) diversity. The current research would explore means of coordinating and mainstreaming biodiversity policies, monitoring progress towards the achievement of biodiversity goals and develop a local biodiversity index for biodiversity profiling.

Due to time and resource constraints, this research will apply the principles of the CBI, will identify selected indicators and set up the framework for a custom-made local biodiversity information system that will be used to calculate the local biodiversity index. This research will not involve conducting in-depth data collection on the indicators; instead will develop a local biodiversity index based on secondary data from policy provisions on local biodiversity, its application in planning permit application processes, number of planned local biodiversity initiatives, biodiversity offsetting, and government commitments to biodiversity. These criteria will have equal scores to add up to the local biodiversity score (index) which could be used to monitor the status and trends of biodiversity loss over time.

The existing literature on the ecological mechanism by which plant diversity and species composition are assessed and controlled is scarce, especially when applied to ecosystem diversity (Van der Heijden, *et al.*,1998), planning permit process and regional policy development. This research will advance on these knowledges and research gaps and suggest solutions and recommendations to address the biodiversity policy issues identified.

2.2 Theoretical Framework

A theory is normative when it provides an explanation of what ought to be and attempts to explain what it is (Ostrom, 1991; Donaldson and Preston, 1995). Theory involves developing a body of knowledge and its process. The theoretical framework for this research on the implementation and evaluation of local biodiversity policies is the concept of planetary boundaries (Rockstrom *et al.*, 2009a).

Rockstrom *et al.*, (2009a) proposed a new path to global sustainability in which they described planetary boundaries within which humanity can operate safely. “Planetary boundaries define a science based safe operating space for human prosperity in a world with growing development needs and rising environmental risks” (Schultz *et al*., 2013).

The planetary boundary concept was used to estimate a safe operating space for humanity considering the Earth system’s functions and processes (Rockstrom *et al.*, 2009a; Schultz *et al.,* 2013). They established nine vital earth processes for which there are boundaries which subsequently define the thresholds (Rockstrom, *et al*. 2009a; Rockstrom, *et al*. 2009b; Bradshaw and Sykes, 2014).

Thresholds are intrinsic features of systems and are determined along a continuum of control dynamics, while boundaries are human determined values of the control

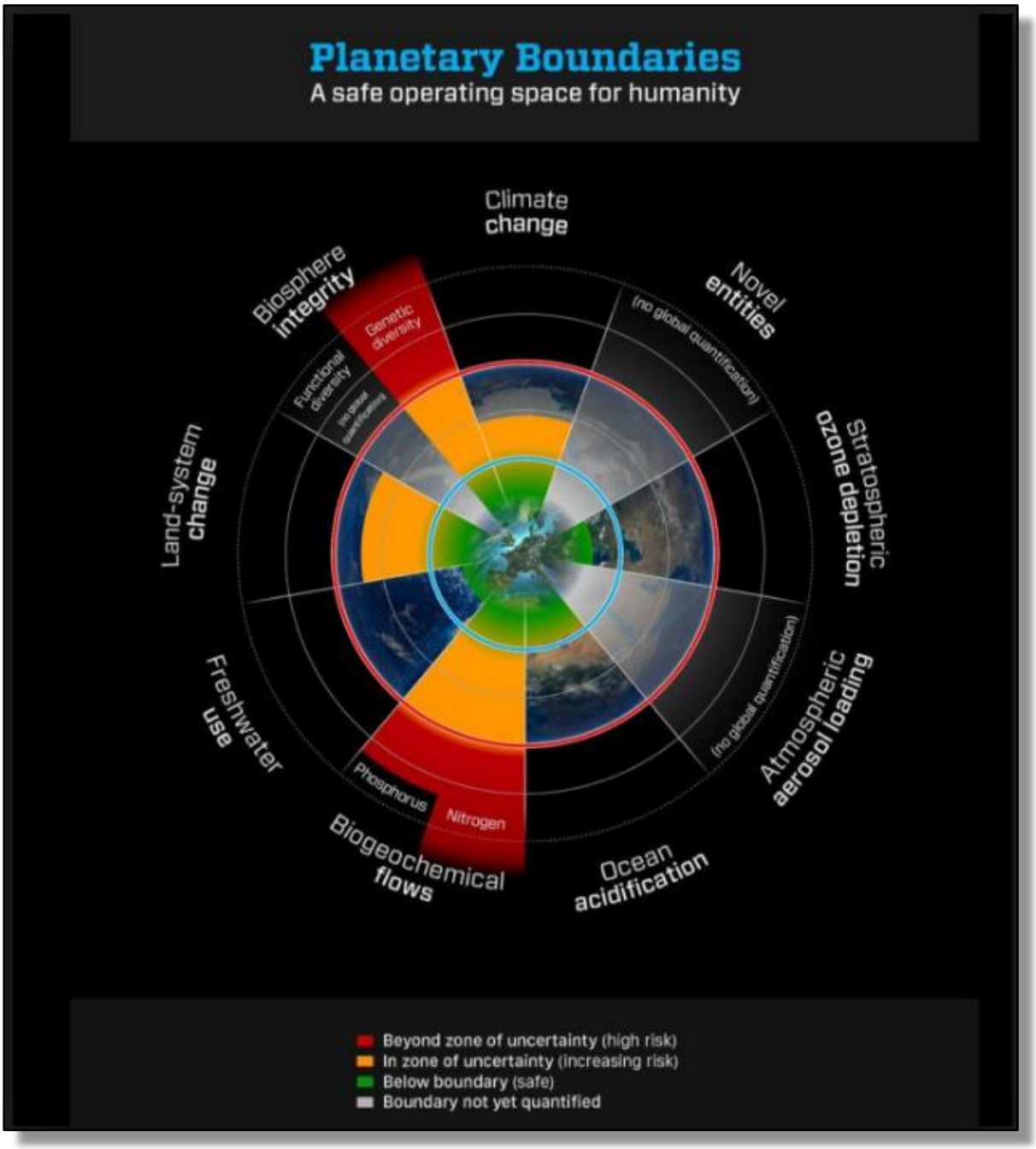
dynamics set at a distance to define the safe operating space beyond which is the zone of uncertainty (Rockstrom, *et al*. 2009a). However, the determination of safe distance is dependent on standard judgement and societal response to risk and uncertainty.

The concept of planetary boundaries stems from the presumption of the earth's dynamic system, safe limits, finite resources, interrelated earth thresholds and the paradigm shift from the Holocene era to the Anthropocene era (Rockstrom, *et al*. 2009a; Rockstrom, *et al.* 2009b; Bradshaw and Sykes, 2014) which signals humanity's overuse of the planet's limited resources. A framework based on 'planetary boundaries' was proposed to define a safe operating space for humanity and is associated with the planet's biophysical subsystems or processes.

To this view, nine ecosystem processes (planetary boundaries) have been identified and these include "climate change, biodiversity loss, change to the nitrogen and phosphorus cycles, freshwater use, land system change, ocean acidification, stratospheric ozone depletion, chemical pollution and aerosol loading" (Rockstrom, *et al*. 2009a:1; Rockstrom, *et al.* 2009b:472). Four out of the nine planetary boundaries identified, are currently being exceeded and these include climate change, biodiversity loss, land use (deforestation) and nitrogen emissions (Rockstrom, *et al*. 2009a, European Commission, 2015), as shown in Figure 2.3 below.

Furthermore, the various interaction between the different boundaries were examined and two core boundaries (climate change and biodiversity loss which have been exceed) were identified to connect to all other planetary boundaries. These core boundaries are capable of changing the Earth system into a new state (European Commission, 2015). This is vital in policy development to avoid a hostile Earth System.

Figure 2.3 – Planetary Boundaries



Source: Rockström, *et al.,* (2009b:472)

Figure 2.2 indicates nine boundaries and their biophysical safe operating spaces (Rockström *et al.,* 2009a). Green zones denote the biophysical 'safe operating space' for human development and because of our limited knowledge of the complex social environmental interactions of the Earth system, the planetary boundaries concept applies a precautionary approach (Rockström *et al.,* 2009a). "Scientific analysis clearly

confirms that the current rate of biodiversity loss is unsustainable and risky for human societies, and transgresses the safe boundary at a planetary scale. This boundary is measured in terms of the extinction rate (number of species per million species per year). The proposed boundary is 10 species/million species/year, while the current status is over 100 species/million species/year, and the preindustrial value was 0.1 – 1 species/million species/year" (Schultz, *et al.,* 2013:1). Consequently, this ecosystem process rate of biodiversity loss has been exceeded approximately ten times.

Rockstrom, *et al.* (2009a) stated that the planetary boundaries approach is embedded in three scientific inquiries – the scale of human action vis-a-vis the Earth's capacity to sustain it; understanding essential Earth system processes; and the framework of resilience and its connections to complex dynamics. "An important proposition is that the planetary boundaries approach focuses on the biophysical processes of the Earth system that determine the self-regulating capacity of the planet (Rockstrom, *et al*. 2009b:472). Similarly, planetary boundaries consider the role of large scale Earth system processes' thresholds which when crossed may initiate non-linear changes in the functioning of the Earth system, thereby challenging social–ecological resilience at regional to global scales (Rockstrom, *et al.* 2009a).

The interaction and interdependence of boundaries (biophysical) necessitate theories that apply a holistic view to biodiversity conservation and management while examining the relationship and interdependence between ecosystem functions and resultant changes. In addition, the planetary boundary of biodiversity loss is observed to have been exceeded (Schultz, *et al*., 2007; Rockstrom, *et al.* 2009a). Planetary boundaries and the safe operating space for humanity, therefore, are relevant to this research in scope and context.

The fundamental notions of the concept of planetary boundaries are the focus on the safe operating space, limits, non-linear interactions and interdependence. Planetary boundaries and the safe operating space provide a structured framework for categorization and assessing biophysical features and their boundaries. In many instances, planetary boundaries provide scholastic means of assessing situations. The application of the general principles of planetary boundaries and safe operating space is relevant and applicable in biological diversity (Rockstrom, *et al*. 2009a; Rockstrom, *et al*. 2009b; Schultz, 2013; Bradshaw and Sykes, 2014).

Advancement in theories and the existing body of knowledge has challenged and transformed the traditional perspective of biodiversity into a comprehensive approach to science. Biodiversity conservation requires wholesome observation, and scientific analysis to document/inform implementation of policies aiming to improve and maintain genetic, species and ecosystem diversities. The planetary boundaries and the safe operating space in biodiversity management focus on the relationship between the resources, users (human) and their spheres of interaction (activities) and on the interdependence of resources, users and activities in biodiversity management practice. Therefore, the concept of planetary boundaries provides a platform for assessing the interaction and interdependence of biodiversity policies, processes and institutions to achieve coordinated, monitored and well-documented local biodiversity policies implementation.

CHAPTER THREE - OVERVIEW OF CASE STUDIES

3.1 Introduction

Biodiversity is a topical issue in recent times across the world because of the increasing pressure on the environment. Human activities and natural processes have immense implications on the amount, variety and variability of natural resources. Therefore, there is need for conscious and joined-up effort to address issues of loss of biodiversity at all levels.

The state, trend and threats to biodiversity vary greatly according to prevailing circumstances. The management of resources in the environment is becoming increasingly important in recent decades. This scenario is complicated by human induced activities and environmental challenges which stretch the utilisation and carrying capacity of these resources resulting in global decline in biodiversity. This research suggests a holistic approach and assessment to local biodiversity policy implementation in line with other overarching policies and strategies.

The research discussed the main challenges of local biodiversity policies implementation in NL which are uncoordinated policies and improperly monitored policy targets, initiatives and programmes. It applies the concept of planetary boundaries to articulate effective interaction and efficient interdependence of biodiversity management systems. Finally, the research identifies policy gaps and suggest best practices to address the main challenges of local biodiversity policy implementation. This research supports the debate for relevant theories and appropriate methodology in biodiversity management research. according to diverse factors that influence resultant environmental dynamics. Furthermore, there are differential responses to these environmental challenges, thereby dictating the precautionary approach to biodiversity conservation. This is further amplified by a

comparative account of the biodiversity conservation approaches in the UK and in NL province, Canada. The historical and contextual perspectives of biodiversity and related policy formulation, implementation and review processes and issues in the UK are also further discussed below. Consequently, biodiversity and policy formulation, implementation and review issues are highlighted in a view to present the existing policy initiation, implementation and evaluation in these case studies. Aside from these, best practices in biodiversity conservation and policy implementation and evaluation in the UK are identified with a view to replicate them in NL province.

Biodiversity reflects the number and variety of all life on Earth which comprises all species of animals and plants, and the natural systems that support them (Joint Nature Conservation Committee, 2016b). Biodiversity is important because it provides the life support system for all life on earth besides vital benefits for humans from the natural environment. It contributes to the human economy, health and wellbeing, and it enriches peoples' lives. Biodiversity is a topical issue in recent times across the world because of the increasing pressure on the environment (Joint Nature Conservation Committee, 2016b).

3.1.1 The European and International Context

At the international level, biodiversity involves agreed conventions and legislation, an ecosystem approach, focus on overseas territories and dependencies, assessing global impacts and operational instruments (The Intergovernmental Platform on Biodiversity and Ecosystem Services - IPBES). The European Union (EU)'s environmental legislation is complemented by a variety of other non-binding policy instruments such as strategies, programmes and action plans to address the wider

use of terrestrial and marine resources (Joint Nature Conservation Committee, 2016b).

3.1.2 The European Union Biodiversity Strategy

In May 2011, the European Commission ratified a new approach to halt the loss of biodiversity and ecosystem services in the EU by 2020, in line with the Convention on Biological Diversity's (CBD) commitments in 2010. The strategy includes a new vision stating that "by 2050, EU biodiversity and the ecosystem services it provides – its natural capital – are protected, valued and appropriately restored for biodiversity's intrinsic value and for their essential contribution to human wellbeing and economic prosperity, and so that catastrophic changes caused by the loss of biodiversity are avoided" (European Commission, 2016).

The strategy contains six targets and 20 actions. The six targets cover: "full implementation of EU nature legislation to protect biodiversity; better protection for ecosystems, and more use of green infrastructure; more sustainable agriculture and forestry; better management of fish stocks; tighter controls on invasive alien species; and a bigger EU contribution to averting global biodiversity loss" (Joint Nature Conservation Committee, 2014: para.3).

The agenda for the adoption of the new EU Biodiversity Strategy (EU-BS) by the Environment Council in June 2011 was initiated by the failure to meet the 2010 biodiversity target set in 2001. The new EU-BS main targets, as listed above, are aimed at protecting and contributing to avert biodiversity loss.

The EU-BS was drafted by the European Commission based on the Global Policy Framework as shown in Figure 3.1. It is also aimed to promote conserving biodiversity within its own territory and it is also the avenue through which the EU intends to fulfil

Figure 3.1 The Global Policy Framework

Source:http://www.bing.com/images/search?view=detailV2&ccid=kTdoW%2BWh&id=4FBFB57FE6549F60EE081F69E16373B0C29A14CB&thid=OIP.kTdoWWh3Pmsw6WoRACeQEsDf&q=EU+biodiversity+strategy+2011&simid=608037031199248283&selectedindex=7&mode=overlay&first=1

its commitment as a signatory to the international agreement on global biodiversity target. A new set of biodiversity targets (the Aichi targets and the Strategic Plan 2011 – 2050 were agreed at the CBD 10th Conference of the Parties in Nagoya, Japan in 2010 (JNCC, 2014). The Aichi Target 11 is relevant to this study on biodiversity and protected areas especially as it relates to land use management to meet urban and regional development needs.

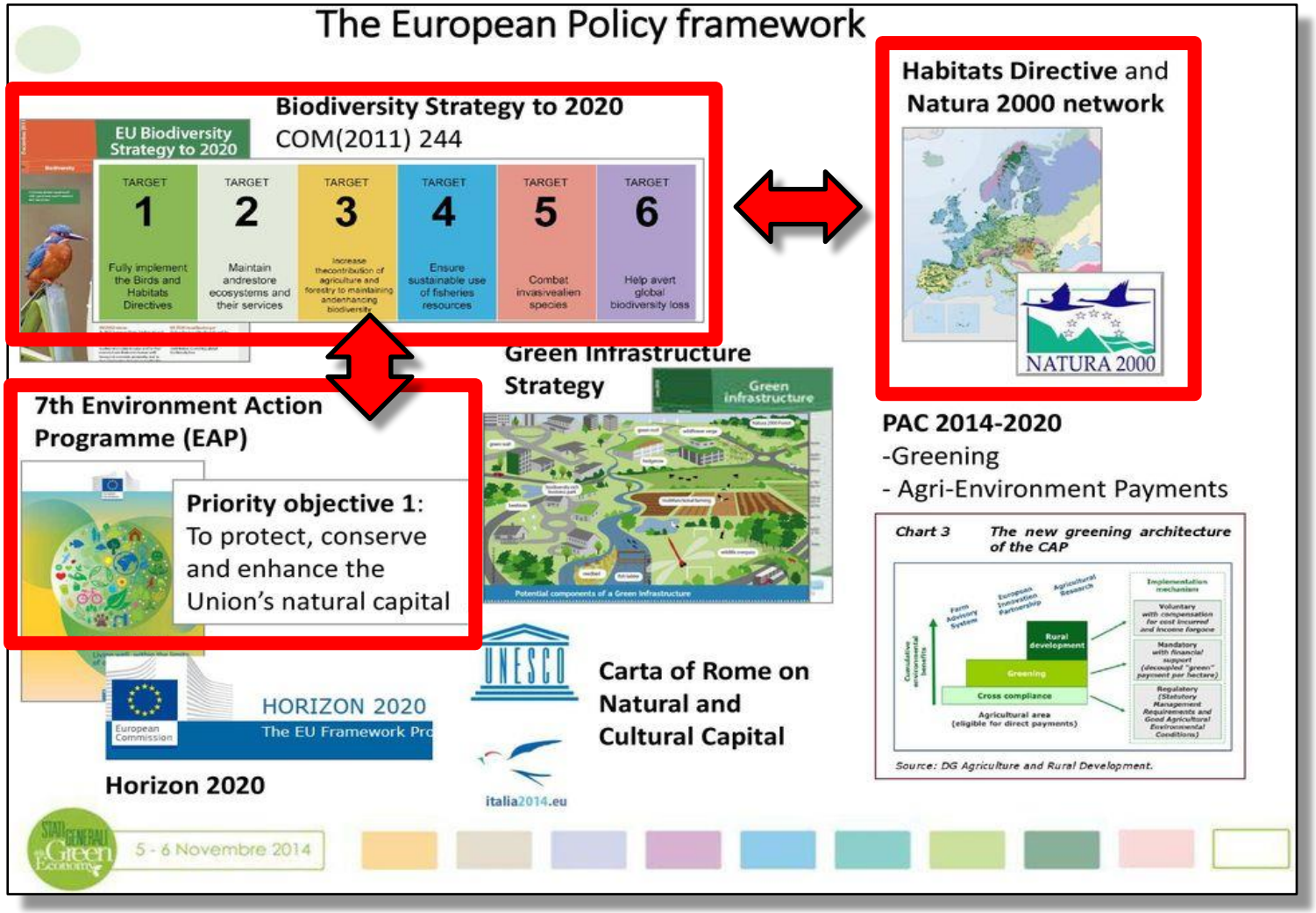
A policy instrument which provides the framework to manage the use of land and to implement the EU-BS in accordance with the Aichi Targets is the EU Environmental Action Programme. This is the framework for policy-making in the Environmental Action Plan (EAP). This plan period is from 2013 – 2020 and it has nine priority objectives and three key areas (to protect and enhance nature and biodiversity; boost resource efficient, sustainable growth; and to improve environmental links with health) (JNCC, 2014). The goals of the EAP are achieved by better implementation of existing legislation, by enhancing knowledge, through larger investments and full integration of environmental issues into policy. The programme intends to make EU cities more sustainable and it is applied across boundaries on a global scale. The EU EAP is a top environmental priority which will be regularly monitored and will be revaluated in 2020 (JNCC, 2014).

There is a reporting obligation under the Nature Directives (Birds and Habitats). The European Commission requires the production of reports to present progress towards meeting the objectives of the Birds and Habitats Directives and the conservation trend and status of species and habitats listed. Habitats Directive is to assess the implementation of the Directives on species and habitats and the assessment is focused on outcomes. The reporting cycles are at six year intervals and three reporting rounds (1994-2000, 2001-2006 and the most recent 2007-2012) under the Habitats

Directive have been produced, while the Birds Directive requires reports on the implementation of the Birds Directive every three years. There have been nine reporting rounds between 1983 – 2007. Strategically, the EAP is situated within a wider European Policy Framework which incorporates other strategies and policies at the regional (European) level, as shown below in Figure 3.2.

It is worthy to note that the reporting periods are not synchronised, making the overview of implementation of the two directives difficult. It is important to note that the EU biodiversity policy is based on the international ecosystem approach. In addition, the conservation technique is at the centre of the UK biodiversity initiative.

Figure 3.2 European Policy Framework



Source:http://www.bing.com/images/search?view=detailV2&ccid=DjfmOpNE&id=4FBFB57FE6549F60EE08C7A81CC08FF88FC3DD9E&thid=OIP.DjfmOpNEV_VlyAQCT57IjQEsDe&q=EU+biodiversity+strategy+2011&simid=607991465884716268&selectedindex=23&mode=overlay&first=1

3.1.3 Biodiversity Conservation and Information System in the United Kingdom

The UK is a signatory to the CBD and is committed to the biodiversity goals and targets 'the Aichi targets' agreed in 2010. These are set out in the Strategic Plan for Biodiversity 2011-2020. The UK is also committed to develop and use a set of indicators to report on progress towards meeting these international goals and targets (Joint Nature Conservation Committee, 2016b). There are related commitments on biodiversity made by the EU, and the UK indicators may also be used to assess progress with these.

Generally, nature conservation tends to sustain and enrich biodiversity. UK nature conservation is driven by various policies, legislation and agreement from various stakeholders (the statutory, voluntary, academic and business sectors). The UK has demonstrated innovation and leadership through successive biodiversity strategies which take a devolved, integrated, ecosystem approach to the implementation of activities needed to address biodiversity loss (JNCC and Defra, 2012:4).

In 1994, the UK produced the first national biodiversity action plan (the UK Biodiversity Action Plan – UK BAP), based on its obligation to the CBD. However, "biodiversity policy is a devolved responsibility in the UK: England, Scotland, Wales and Northern Ireland have each developed or are developing their own biodiversity and environmental strategies" JNCC, 2015: para.3).

The Joint Nature Conservation Committee (JNCC) organised conservation action and research in the UK and published the 'UK Post-2010 Biodiversity Framework'. This framework incorporates the common purpose "(International/European context, facilitating and contributing to common country approaches and solutions, evidence provision and reporting)" (JNCC and Defra,

2012:2). It also includes shared priorities "(production of National Biodiversity Strategy and/or Action Plan (NBSAP)" and achieving "The 20 Aichi targets through the five strategic goals" (JNCC and Defra, 2012:2) of the four countries (England, Scotland, Northern Ireland and Wales) and was endorsed by their governments' agencies.

The UK Post-2010 Biodiversity Framework (17 July 2012) was developed based on two major drivers: the CBD's Strategic Plan for Biodiversity 2011-2020, its five strategic goals and the 20 'Aichi Biodiversity Targets' and the launch of the EU-BS (Joint Nature Conservation Committee, 2016f: para.6). The framework is developed to demonstrate how the activities of the four countries are coordinated at a national (UK) level to achieve the 'Aichi Biodiversity Targets' and the aims of the EU-BS. The framework identifies how the country biodiversity strategies contributes to international obligations and how to complement these strategies. This framework typifies an approach which signifies a paradigm shift towards a holistic approach to the management of the environment and to recognise the value of nature in decision-making. The implementation of the UK Post-2010 Biodiversity Framework requires operational tools in the form of biodiversity indicators to monitor and report progress on the trend and status of biodiversity in the UK.

3.1.4 UK Biodiversity Indicators

The UK is a signatory to the CBD commitments, goals and targets ['the Aichi Targets' (2010), Convention on Biological Diversity, 2017] and they are contained in the Strategic Plan for Biodiversity 2011-2020 (Convention on Biological Diversity, 2017). Consequently, there is a commitment to develop and apply a set

of indicators to monitor and report on the achievement of these international goals and targets.

These indicators are designed to monitor progress in each country with the specific purpose for international reporting and were a result of consultation and agreement between the stakeholders and the administrations. Consequently, a set of 18 indicators initially developed for reporting against previous international targets has been broadened to 24 indicators (Department for Environment, Food and Rural Affairs, 2012). The indicators provide an adaptive and flexible framework and comparative methodologies for country reporting.

The UK biodiversity indicators are based on a wide variety of most robust, reliable and available data, provided by Government, research bodies, and the voluntary sector. The indicators present shifts in various aspects of biodiversity, such as the value of biodiversity, global biodiversity impact, climate change adaption and protection areas, to mention few. However, the indicators may be subject to further review as necessary (see Appendix 1 for the list and status of the UK biodiversity indicators).

3.1.5 UK Habitats and Species

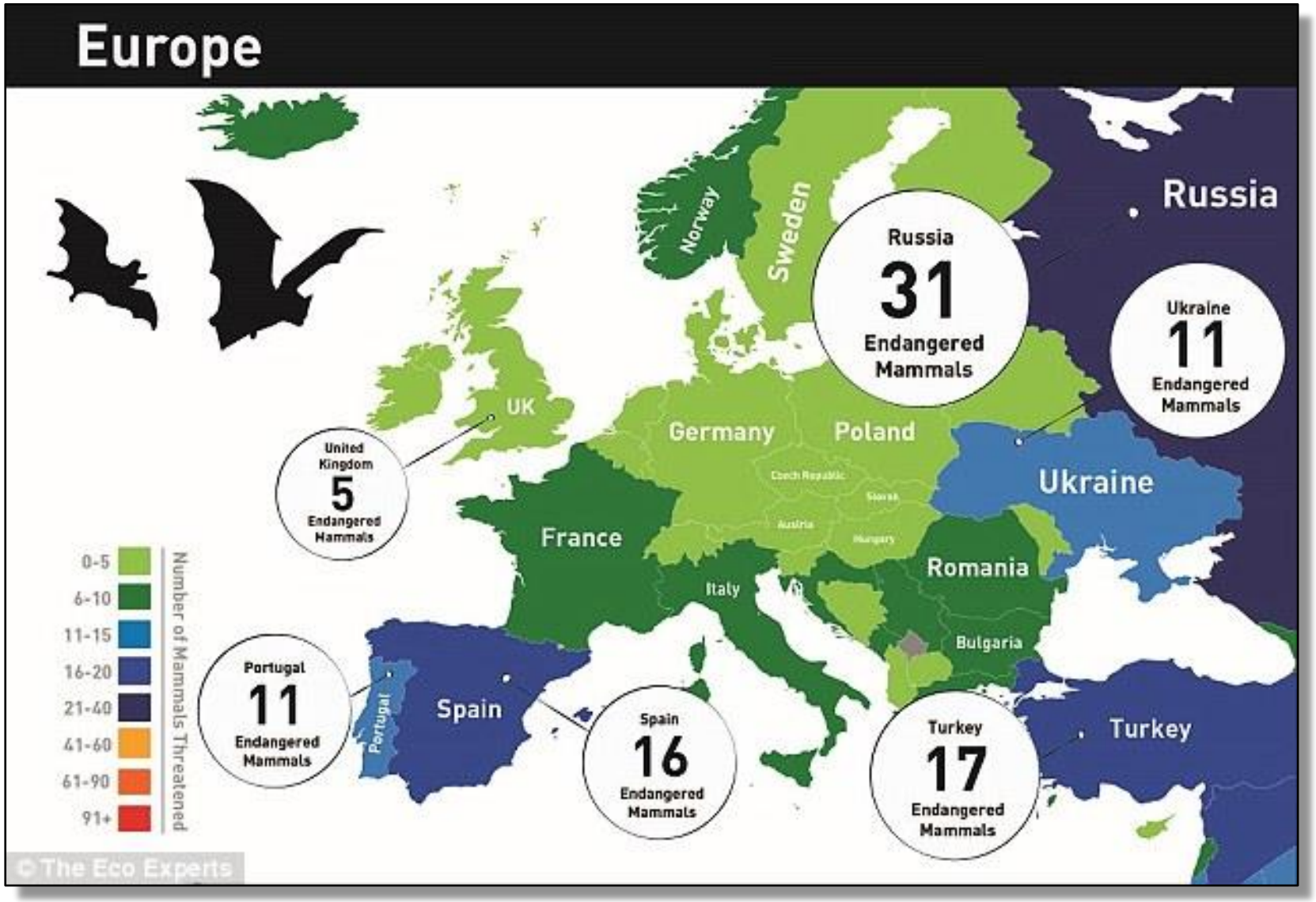
There is abundance of habitats and species in the UK. The JNCC is responsible for habitat and species conservation in the UK. This is done through the provision of advice and development of surveillance and monitoring initiatives which contribute to assess the status, trends and threats of species and habitats in the countryside. Information from these initiatives are used in problem identification, prioritising conservation actions and assessing the success of conservation activities. Currently, there are 65 priority habitats in the UK (JNCC, 2016d).

Similarly, there are up to 1,150 priority species in the UK as contained in the Species and Habitats Review Report, 2007 (JNCC, 2016e). At this juncture, the availability and distribution of these habitats and species are relevant to the state, trend and threat of biodiversity loss. The level of threat on species in the UK is relatively low compared to the rest of Europe, as described in Figure 3.3. This reflects the on-going nature conservation activities in the UK.

3.1.6 UK Protected Sites

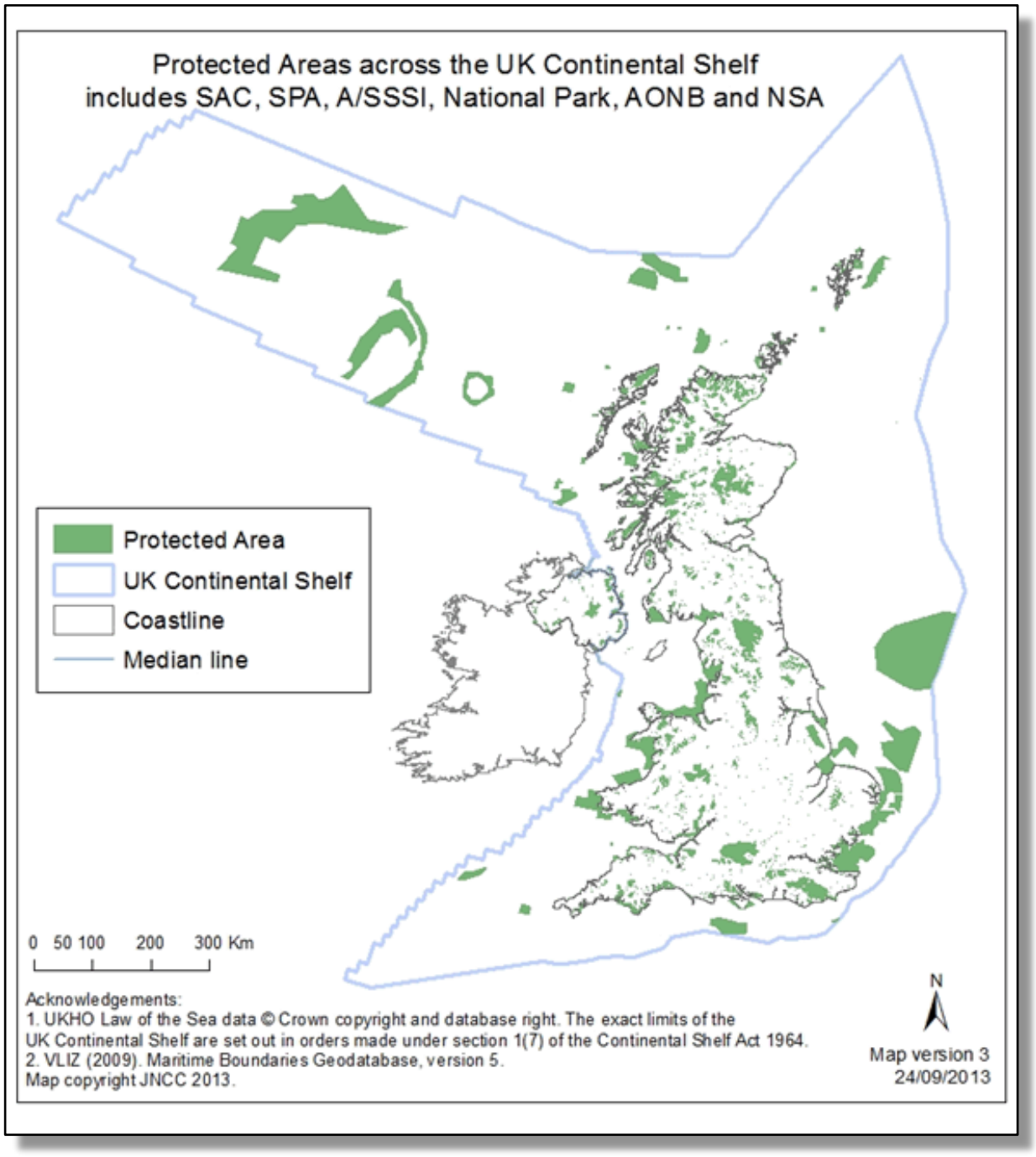
There are many protected areas in the UK and the JNCC designates protected areas in order to conserve and enhance habitats, earth features and species. Information is collected on designated sites to support nature conservation and explain the criteria for site selection. The UK Protected Sites are graphically presented in Figure 3.4 below.

Figure 3.3 Threatened Species in Europe



Source:http://i.dailymail.co.uk/i/pix/2015/04/13/15/2786BFBD00000578-3037027-The_UK_has_five_endangered_mammals_but_these_are_almost_exclusiv-a-91_1428935444706.jpg

Figure 3.4 Protected Sites in the UK



Source:http://www.bing.com/images/search?view=detailV2&ccid=3lhFJhCZ&id=7FE2102487170B1074B5B40CCD3577E781E1740B&thid=OIP.3lhFJhCZccdLpaY0NMlL7wENEs&q=protected+areas+uk&simid=608035755595598753&mode=overlay&first=1

3.1.7 UK Legislation

The origin of the laws and regulations applicable to biodiversity conservation and its regulation is found at global, EU, national and sub-national levels. There are differences in nature conservation approaches due to devolution of power. The main legislation addressing nature conservation in the UK is the Wildlife and Countryside Act, 1981 (as amended). This legislation is applied with consideration for the National Planning Policy Framework (NPPF).

The inception and development of biodiversity conservation is better understood through the sequence of activities overtime. A brief timeline, as presented in Appendix 2, describes and highlights the trend of activities, plans and strategies that have been incorporated since the CBD in 1992 up to the publication of the UK Post-2010 Biodiversity Framework in 2012. However, the brief timeline encourages biodiversity coordination and monitoring through policy instruments to guide and direct biodiversity conservation in the UK.

3.1.8 Reporting and Information Sharing

Biodiversity reporting and information sharing in the UK is conducted through a suite of information systems. The UK BAP Species and Habitat Information System provides collated information about priority species and habitat. This information base is complemented by a country-level information system which provides details of the most recent country strategies and documents. In addition, the Biodiversity Action Reporting System (BARS), a web-based information system documents action executed to achieve specific biodiversity objectives and to progress biodiversity planning, coordination of effort and meeting reporting requirements. Furthermore, the Habitat Management on the

Web, is a search engine developed to provide information on management approaches to non-marine habitats in the UK for biodiversity and conservation. These information systems provide good platforms for reporting and sharing of information on biodiversity and conservation issues. They are also applied in the planning system (national planning policy framework) to devise planning instruments to direct biodiversity and nature conservation in England.

3.1.9 National Planning Policy Framework

The NPPF sets out Government's planning policies for England, how they should be applied and the relevant, proportionate and necessary Government requirements. The framework enhances? residents and their local planning authorities to develop local and neighbourhood plans in accordance with the communities' needs and priorities. These efforts are geared towards the achievement of sustainable development dimensions (economic, social and environmental). The pursuit of sustainable development incorporates positive improvements in the transition from net loss of biodiversity to net gains for nature. The NPPF contains provisions which include conserving and enhancing the natural environment. Detailed policy directions in this regard are contained in paragraphs 109 – 125. The overarching provision is in para. 109, which states that

"the planning system should contribute to and enhance the natural and local environment by:

- protecting and enhancing valued landscapes, geological conservation interests and soils;
- recognising the wider benefits of ecosystem services;

• minimising impacts on biodiversity and providing net gains in biodiversity where possible, contributing to the Government's commitment to halt the overall decline in biodiversity, including by establishing coherent ecological networks that are more resilient to current and future pressures;

• preventing both new and existing development from contributing to or being put at unacceptable risk from, or being adversely affected by unacceptable levels of soil, air, water or noise pollution or land instability; and

• remediating and mitigating despoiled, degraded, derelict, contaminated and unstable land, where appropriate" (Department of Communities and Local Government, 2012).

All these provisions contained in the NPPF are aimed at favouring sustainable development and improving the existing biodiversity infrastructure through local planning policies and partnerships.

3.1.10 Strategic Biodiversity Partnership

Different strategic biodiversity partnerships exist in boroughs and counties across England. However, a relevant strategic biodiversity partnership in terms of scope and context is established within the North Northamptonshire. It was formed from the strategic partnership of neighbouring Borough and District councils. These councils are Corby Borough Council, Kettering Borough Council, Borough Council of Wellingborough and Northampton Borough Council.

The implementation instrument of the strategic biodiversity partnership is the North Northamptonshire Joint Planning Unit. The North Northamptonshire Joint Planning Unit, a local partnership of Corby, Wellingborough, Kettering and East Northamptonshire councils together with Northamptonshire County Council work

together to create an overall plan for North Northamptonshire. All these borough and county councils require an operational Biodiversity Supplementary Planning Document (SPD) to execute biodiversity conservation within their areas of jurisdiction.

3.1.11 Biodiversity Supplementary Planning Document (SPD)

The Biodiversity SPD is a statutory Local Development Document (LDD) prepared under the 2004 Planning and Compulsory Purchase Act (the "2004 Act") with operational coverage of the entire Northamptonshire and adopted by the respective Local Planning Authorities as a statutory SPD. This SPD supplements policies and strategies within the North Northamptonshire Core Spatial Strategy (2008) and West Northamptonshire Joint Core Strategy Local Plan (Part 1 - 2014). It is also consistent with the draft North Northamptonshire Joint Core Strategy 2011-2031.

Each local authority has a statutory commitment to conserve biodiversity and this is addressed by incorporating nature conservation policies in Northamptonshire's core strategies and saved policies (previous development policies) of each borough/district. The SPD aims to integrate biodiversity into the development process in order to aid the achievement of legislation and policy requirements and ensure best practice standards are met. It is applied in conjunction with the main principles of the NPPF, local planning policies and ecological assessment. The biodiversity policy framework described herein, reveals how well-connected biodiversity concerns are enshrined in the planning system and geared towards the achievement of the overall biodiversity targets.

This is evident by the articulation of biodiversity policy issues in North Northamptonshire Joint Planning Unit.

3.1.12 Biodiversity Policy Cycle Issues in North Northamptonshire Joint Planning Unit (NNJPU)

The biodiversity conservation policy issues in North Northamptonshire was initiated by a clear agenda setting based on the recognition of the EU's failure to meet the 2010 biodiversity target set by the European Council in Gothenburg (2001), where Member States committed to halt the decline of biodiversity in the EU by 2010 (Joint Nature Conservation Committee, 2014).

The challenge to achieve this agenda trickled down to different levels of governance and administration but geared towards the overarching agenda which is to halt the decline of biodiversity in the EU. This has shaped policy agenda setting in NNJPU. Biodiversity policy agenda setting was initiated by the combination of intense public complaints, general biodiversity loss in both built-up and natural environment, need to be close to nature and statutory requirements, to mention few. The explanatory factors that justified this phase in the policy development process include the importance of environmental stewardship, citizens' articulation of preference process, local governance (interaction and participation) and Northamptonshire's responsibilities towards its residents.

Policy formulation

The legislative instruments establishing biodiversity supplementary planning documents are the 2004 Planning and Compulsory Purchase Act (the "2004 Act") and Town and Country Planning (Local Planning) (England) Regulations 2012 (Statutory Instrument 2012 No. 767). Germane to this, local planning authority

was responsible for formulating a supplementary planning document for biodiversity policy.

The four local planning authorities established the North Northamptonshire Joint Planning Unit to facilitate the formulation, implementation and review of biodiversity policy. NNJPU and stakeholders have identified and analysed available policy options, considered existing environmental regulations and analysed the impacts of policy options to formulate biodiversity policy goals to improve biodiversity and quality of life. Policy objectives (plans, strategies and programs) were drafted to address biodiversity loss.

The driving factors for this policy phase include setting goals, decision to 'act', estimating risks, cost and benefits, choice of available policy instruments, meeting environmental and biodiversity standards, political interests and agenda, while the explanatory factors justifying this phase were to deliver a 'public good' (improved biodiversity and good environmental stewardship) and to perform governmental duties.

Decision making / Legislation

Four local planning authorities in Northamptonshire formed a Joint Planning Unit to address planning related issues within North Northamptonshire area. This led to draft a SPD on biodiversity for the planning area. The SPD on biodiversity was drafted in line with Northamptonshire Biodiversity Action Plan.

The decision to act was influenced by various proposals for solutions, such as the adoption of national biodiversity policy, or delegating biodiversity management duties to local planning authorities. The draft SPD on biodiversity was presented, debated and adopted by various Councils. The North

Northamptonshire's Supplementary Planning Document on Biodiversity was adopted in July 2011.

The driving and explanatory factors that justified this policy phase were Government's constitutional duties, level of rational decision making, citizen acceptance and participation, and political objectivity and transparency.

Policy Implementation

The NNJPU is the leading institution for the formulation, implementation and monitoring of the North Northamptonshire biodiversity policy; other stakeholders were actively involved at various levels. The implementation plan for North Northamptonshire biodiversity policy utilised existing Northamptonshire Biodiversity Action Plan. The policy was planned to be reviewed as need arises through the consultation of the public and direction from the NNJPU and other stakeholders. The implementation plan focussed on financing, responsibilities, roles and specific biodiversity conservation programs and activities and specified actors, process and outcomes. Policy implementation was more regulatory (command-and-control) and informative at the local level than at the regional and national levels.

- *Financing*

The four local planning authorities in the NNJPU provide larger proportion of the funds (technical personnel, money and other resources) to implement the policy, while the rest were contributed through community engagements, private sector sponsorships and participations from NBRC, Northamptonshire Biodiversity Partnerships and others.

- *Roles and Responsibilities of Executing Institutions*

The roles and responsibilities of the executing institutions varied accordingly for the achievement of policy objectives. NNJPU is the leading institution coordinating strategic visioning and implementing biodiversity programs, public enlightenment, and technical and financial support. Northamptonshire Biodiversity Partnership and NBRC provide advisory and advocacy, community awareness and involvement, planning and policy, and data, monitoring and evidence.

- *Policy Instruments*

Biodiversity policy applied a combination of policy instruments to set agenda, formulate, implement and monitor biodiversity conservation policy. These policy instruments were a) regulatory and command-and-control - this involved the application of existing legislations at local and regional levels; b) public outreach and education – this involved the use of the mass media to disseminate information for public awareness and engagement. The driving and explanatory factors for this policy phase include intention for positive change, choice of policy instruments, addressing biodiversity conservation issues, linkage between policy programs and policy instruments, identifying ‘actors’ and their roles and meeting budgetary and statutory requirements.

Policy monitoring and evaluation

The North Northamptonshire Joint Planning Unit, in conjunction with NBRC, Northamptonshire Biodiversity Partnership and other local partnerships, monitor the biodiversity conservation policies focussing on evidence gathering and compliance, while actual evaluation was conducted by the NNJPU through AMRs.

Policy monitoring was evidence based (policy focus areas), while policy evaluation was outcome-based using indicators. The policy focus areas used for policy monitoring include: levels of service, capacity development, legislation and regulation, information, education and communication, financing and cost recovery, research and development and monitoring and evaluation. The indicators include: area of coverage, measuring effectiveness, efficiency, impacts (social, ecological and economic), compliance (number of violators), identify policy gaps and produce quarterly and annual monitoring and evaluation reports. This involved developing appropriate indicators for each policy focus areas. These indicators formed the basis for evaluating policy impacts in order to reassess policy goals and objectives.

3.1.13 The Northamptonshire Biodiversity Records Centre (NBRC)

NBRC is the Northamptonshire biological and geological information centre, established in 2006 with support from statutory and non-statutory bodies. NBRC collects (from local voluntary recorders and various organisations), manages and controls access to information about species, habitats and designated wildlife and geological sites for diverse users. The NBRC facilitates biological recording to enhance NNJU's biodiversity information need for planning decision making in relation to conservation, sustainable development and natural capital stewardship for public benefit (NBRC, 2014).

The existing framework for biodiversity conservation in the UK as presented above, are developed to address the failures of the past biodiversity conservation pursuits, to meet both local and international targets and to provide a foundation to build upon for the future. The UK biodiversity conservation framework connects

various actions, policies, strategies by different units at various levels, with different roles in coordination to implementation. The UK biodiversity conservation framework exhibits best practices that can be replicated elsewhere. However, there is need for improvement in agenda setting, formulation and review of goals and objectives, implementation and information collection and sharing to reflect biodiversity conservation needs, changing the biodiversity conservation paradigm, or environmental resource and management practices.

3.2 Rationale for a Biodiversity Conservation and Information System in NL

Extreme environmental change presents ecological concerns to the people, such as the disruption of natural processes through ecosystem services - air and water purification, natural resource production, and other benefits to humanity. Therefore, it requires management and policy responses. “Humans are rapidly altering the environment of many species, reducing range size and habitat quality and altering ecological processes” (Biodiversity Research Centre, 2017). Furthermore, “the MEA shows that human actions often lead to irreversible losses in terms of diversity of life on Earth and these losses have been more rapid in the past 50 years than ever before in human history” (Greenfacts, 2016b).

Historically, environmental concerns in Canada have been addressed through different policy (procedural, substantive and institutional) means. This has influenced the availability of policy instruments and policy considerations for choosing implementation tools. It started at the beginning of the 1970s with the establishment of the basic institutional tools for policy implementation such as departments and ministries of the environment. Subsequently, this progressed by legislative frameworks for applying procedural and substantive instruments.

However, there has been a paradigm shift from substantive policies to procedural and institutional policies. Hence, the development of the CBS to address the trend and status of biodiversity loss and to meet local and international targets.

3.2.1 Canadian Biodiversity Conservation

The CBS is a policy instrument developed as a response to the commitment to the CBD, and is designed to meet local and international targets. The CBS aims to achieve five main goals, as follows:

- to achieve sustainable conservation of biodiversity and use of biological resources;
- to improve the understanding of ecosystems and increase resource management capacity;
- to promote an understanding of the need for sustainable conservation of biodiversity and use of biological resources;
- to develop incentives and legislation that support sustainable conservation of biodiversity and use of biological resources; and
- to collaborate with other countries for sustainable conservation of biodiversity and use of biological resources and equitable share of benefits from the utilization of genetic resources.

These are the overarching goals at the national level in Canada. Other biodiversity frameworks, sub-national biodiversity strategies, local strategies, actions and initiatives at different jurisdictions are geared towards the achievement of these overarching goals. The CBS is operationalised through the Biodiversity Outcome Framework. The Canadian Biodiversity Outcomes Framework attempts to prescribe how the overarching goals of the CBS can

be met. This framework, specifies the steps and activities to achieve the aims and objectives of the national biodiversity strategy; it aims to complement, advance, identify and connect “current and future priorities; endeavours to engage Canadians in planning and implementation and to report on progress; and highlights and guides progress towards Canada’s Biodiversity Outcomes, as shown in Figure 2.1.

Furthermore, according to the agreement and commitment under the CBD, the 13 provinces and territories in Canada are required to develop their sub-national biodiversity strategies. The sub-national biodiversity strategies are meant to be prepared at the provincial and territorial levels and these sub-national strategies are intended to operationalise and complement the national biodiversity strategy. However, all the provinces and territories have not met this requirement. Precisely, NL province has not met this requirement.

The Province of NL has not developed a S-NBS, but attempts to achieve the goals of the CBS through a suite of policies, strategies and plans. “The CBS has been integrated into many provincial planning processes in NL, such as development of a provincial sustainable forest management strategy, and protected areas planning. The suite of provincial planning processes used to integrate biodiversity concerns also include the Wildlife Biodiversity Monitoring (WBM), Exotic and Alien Invasive Species, Ecosystem Status and Trends Reports, Wildlife Diseases and Rare Plants. The Endangered Species and Biodiversity Section of the Wildlife Division implements the strategy within NL” (Newfoundland and Labrador province, 2017). Figure 3.5 is a representation of the array of biodiversity assets in NL province, Canada. A brief discussion

of the suite of provincial planning processes will present a clear understanding of the biodiversity conservation in NL.

Figure 3.5 Biodiversity in Newfoundland and Labrador Province

Source: Figure compiled by the author using information from sources (https://www.google.ca/search?q=biodiversity+in+Newfoundland+and+Labrador&rlz=1C1GGRV_enCA750CA750&source=lnms&tbm=isch&sa=X&ved=0ahUKEwixqc7Jh8vUAhVBdz4KHUMGC3UQ_AUICigB&biw=1249&bih=1238#imgdii=zppl6MKgaPEAIM:&imgrc=TDIRoxt0fdI6NM:).

The WBM is a voluntary based program which involves reporting the sighting of the listed species (Dragonfly and Damselfly, Butterfly) and incidental sightings (Newfoundland Marten, Short-eared Owl, Wolverine, FrogWatch, PlantWatch and WormWatch). This program provides information to monitor and protect NL's biodiversity and wildlife resources.

The Exotic and Alien Invasive Species, under the Invasive Alien Species Partnership Program, provides means of educating the public and investigating the invasive alien species issues in NL. This is supported by legislation review of how to protect NL province and prevent the introduction of species from other provinces and territories within Canada and from outside Canada.

Ecosystem Status and Trends Reports aim to contribute towards maintaining healthy and diverse ecosystems. They also enhance the collation of information to assess the state of the ecosystems. The Ecosystem Status and Trends Reports provide science-based information on the status and trends of Canada's ecosystems; ecosystem-based information for articulating the national biodiversity agenda; means of communicating the importance of healthy ecosystems; and baseline information for the status and trends section of the 4th National Report to the CBD. The Ecosystem Status and Trends Reports contain an assessment which provides an "integrated assessment of current status, emerging trends and significant stressors of Canada's ecosystems. It also proposes a new and ongoing system for ecosystem monitoring and status and trends reporting, providing policy-makers with the detailed assessments required to develop policy and alert the public to ecosystem changes of concern" (The Government of Newfoundland and Labrador, 2017b). This is a laudable goal but how well is it achieved?

NL is endowed with rich wildlife and plant species, of which many need assistance to survive. “The Wildlife Division coordinates the assessment and listing of species at risk, and develops recovery and management plans, monitoring programs, and research projects to promote their conservation” (The Government of Newfoundland and Labrador, 2017c). The American marten, Long’s braya and Red Crossbill are part of NL’s landscape and are regarded as Species at Risk. These species are safeguarded by the Species at Risk Policy which ensures that no native species are extinct as a result of human activity or interference. In addition, NL’s Endangered Species Act (2004) provides legislative provision for special protection of endangered, threatened, or vulnerable plant and animal species, with the exception of marine fish, bacteria and viruses in NL province. The Endangered Species Act contributes towards NL’s commitment under the National Accord for the Protection of Species at Risk. Similarly, protective measures are applied in the form of terrestrial and MPAs and supported by the Protected Areas Strategy in NL.

3.2.2 Protected Areas Strategy

The Protected Areas Strategy aims to manage the province’s special natural heritage (protected area network) in healthy diversity for present and future generations for sustainable, viable resource-based economy. The Protected Areas Strategy’s framework is focussed on scientific research, sound conservation practices and the understanding of the processes of ecological systems (The Government of Newfoundland and Labrador, 2017e).

The Protected Areas Strategy was developed to conserve and safeguard unique aspects of the diverse natural heritage for the present and future

generations. In 2004, a total of 55 provincial protected areas and 8 federal protected areas were identified, designated and managed to pursue the Aichi (2010) Biodiversity Target to protect a minimum of 17% of its land and inland waters by 2020. NL province's TPAs (provincial and federal) account for only 4.6% of the land in NL province while Canada's national average was 10% as at 2011. The rate of establishing protected areas has diminished over time.

Protected Areas in NL are divided in two categories – Provincial Protected Areas and Federal Protected Areas. However, there are "six types under provincial jurisdiction and seven under federal jurisdiction" (The Government of Newfoundland and Labrador Province, 2017d: para.1), as presented in Tables 3.1 and 3.2 below. There are 63 TPAs covering about 18,405km^2 (4.52% of the Province area) and the National Protected Land Average is 8.52% as at Nov. 2003 (The Government of Newfoundland and Labrador Province, 2017d). These protected areas are created and maintained for biodiversity conservation, ecotourism, scientific research and purposes.

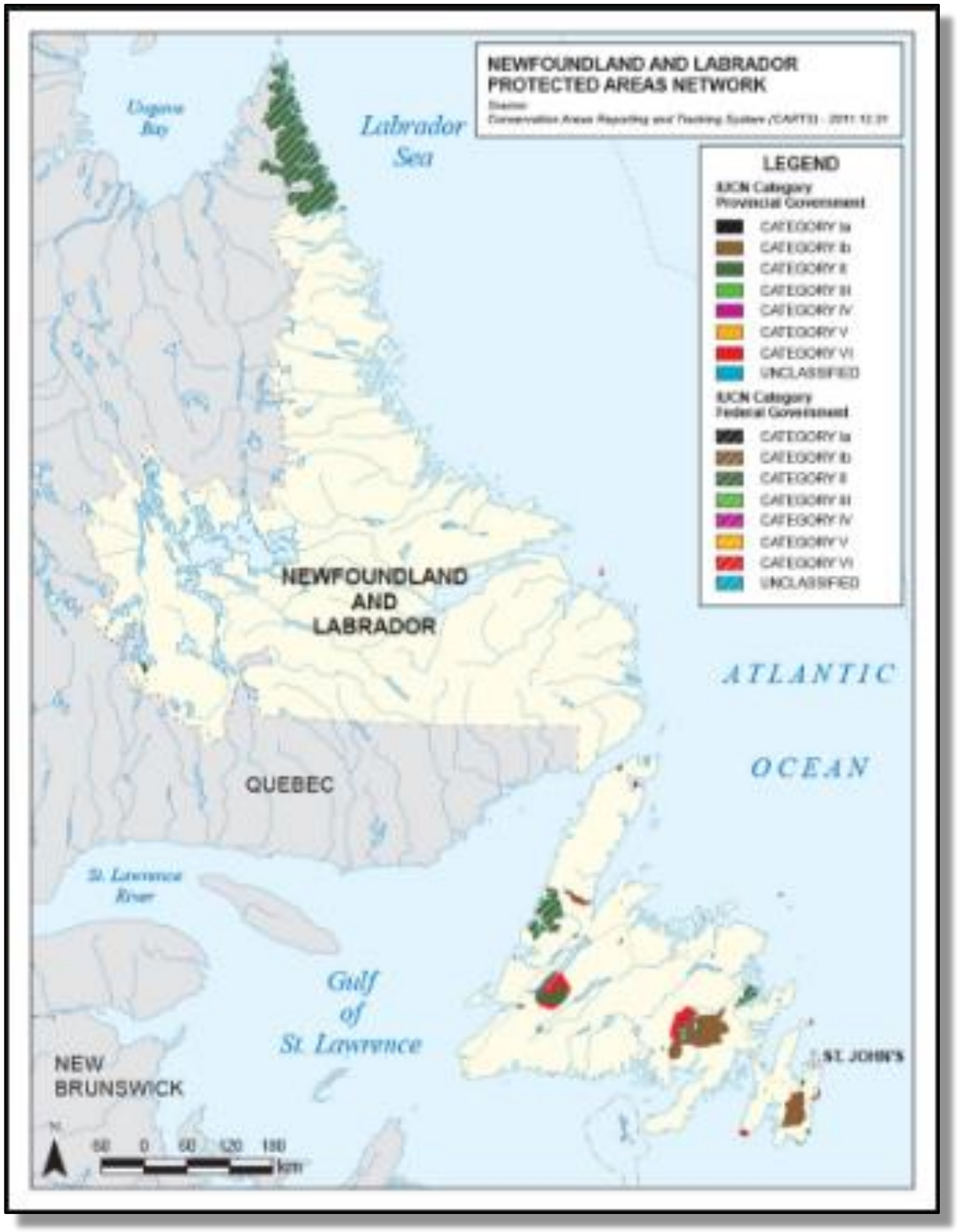
Table 3.1 Protected Areas in Newfoundland and Labrador

Agency	Legislation	Type of Protected Area
Parks & Natural Areas Division Natural Heritage Branch Department of Environment & Conservation Newfoundland & Labrador	Wilderness and Ecological Reserves Act Provincial Parks Act National Parks Lands Act	Wilderness and Ecological Reserve Provincial Park
Wildlife Division Natural Heritage Branch Department of Environment & Conservation Newfoundland & Labrador	Wild Life Act Endangered Species Act[1]	Wildlife Reserve Wildlife Park
Lands Division Department of Environment & Conservation Newfoundland & Labrador	Lands Act[2]	Crown Reserve Special Management Area
Oceans Programs Division Science, Oceans and Environment Branch Department of Fisheries and Oceans	Oceans Act Federal Fisheries Act	Marine Protected Area
Parks Canada	Canada National Parks Act Parks Canada Agency Act Canada National Marine Conservation Areas Act National Historic Sites and Monument Board Act	National Park National Marine Conservation Area
Canadian Wildlife Service Environment Canada	Migratory Bird Convention Act Canada Wildlife Act Cooperative Management Wildlife Area Species at Risk Act[1]	Migratory Bird Sanctuary National Wildlife Area Marine Wildlife Area

[1] This legislation is not designed to establish protected areas, however, it can prescribe land use activities and has implications for the establishment and management of protected areas.
[2] This legislation can be used to grant temporary protection to an area of land, the lead agency is Lands Branch, Environment and Conservation, but authority for site management can be designated to other Ministers.

Source: The Government of Newfoundland and Labrador (2017e)

Figure 3.6 Location of Protected Areas in Newfoundland and Labrador



Source:https://ca.images.search.yahoo.com/yhs/search;_ylt=A0LEVu9NqCdZXmcA5OsXFwx.?p=protected+areas+in+newfoundland+and+labrador&fr=yhs-blp-default&fr2=piv-web&hspart=blp&hsimp=yhs-default&type=hmp_996_692_0#id=20&iurl=http%3A%2F%2Fwww.ec.gc.ca%2Fap-pa%2F8EF4F871-F880-4A6E-BD75-6585F21913FD%2Fapp_map10_eng.jpg&action=click

Table 3.2 Type and Size of Protected Areas in Newfoundland and Labrador

Jurisdiction	Type of Protected Area	Number	Area (km^2)	% Island Protected[(b)]	% Labrador Protected [(b)]	% Province Protected [(b)]
Provincial	Wilderness Reserves	2	3,965	3.56%	0.00%	0.98%
	Ecological Reserves	16	910	0.74%	0.03%	0.22%
	Provincial Parks	31	211	0.18%	0.00%	0.05%
	Wildlife Parks	1	15	0.01%	0.00%	0.00%
	Wildlife Reserves [(a)]	3	1,183	1.06%	0.00%	0.29%
	Public Reserves[(a)]	1	178	0.16%	0.00%	0.04%
	Development Control Area	1	1	0.00%	0.00%	0.00%
Federal	National Parks	3	11,906	1.98%	3.30%	2.93%
	National Historic Sites	2	37	0.03%	0.00%	0.01%
	Migratory Bird Sanctuaries	3	0	0.00%	0.00%	0.00%
Total Land Protected (NL)		63	18,405	7.72%	3.33%	4.52%
Marine = 162km^2 (Ecological Reserves and Migratory Bird Sanctuaries)						
National Protected Land Average (Canada, Nov. 2003)						8.52%

[(a)] Mineral exploration is allowed under permit

[(b)] Based on Island area of 111,390 km^2 and Labrador area of 294,330 km^2

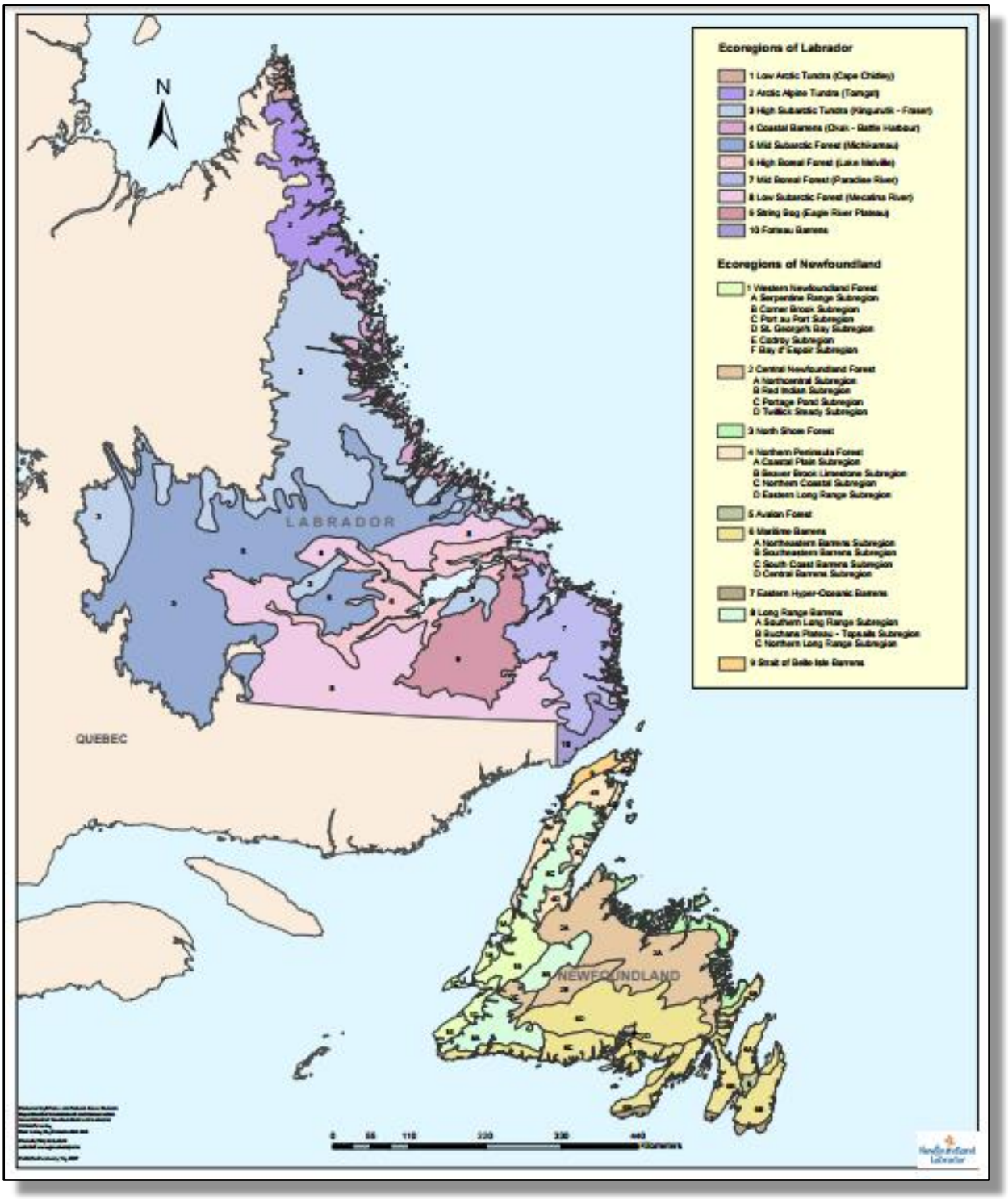
Source: The Government of Newfoundland and Labrador (2017d)

research, recreational and educational purposes. Figure 3.6 shows the location and distribution of these protected areas in NL province, while Tables 3.1 and 3.2 present more details on responsible agency, relevant legislation and type of protected areas and statistics on the protected areas. These protected areas fall under one of the following pieces of legislation: Provincial Parks Act, Wilderness and Ecological Reserves Act, Wildlife Act and Lands Act, as shown in Table 3.1 below. These legislations enhance the administration and enforcement of control in these protected areas. The success of protected areas enhanced the establishment of ecoregions based on natural endowment the protected areas constitute the ecoregions.

Ecoregions are natural regions because they are identified by their distinctive, peculiar vegetation and soil development and are defined by local climate and geology, but they may differ in plants, landscapes, geology, and other features. 19 ecoregions (9 in Newfoundland and 10 in Labrador) and 35 subregions - ecodistricts (The Government of Newfoundland and Labrador, 2017f).

These province's ecoregions and subregions are natural habitat to "1,406 known species of vascular plants, 13 indigenous mammals in Newfoundland and 37 indigenous mammals in Labrador, and 73 species of birds" (The Government of Newfoundland and Labrador, 2017f). Figure 3.7 presents more details about the location and distribution of ecoregions in NL. The province's latitudinal position and aerial coverage provide the northern or southern limits for many plant and animal species. Therefore, the designation of present and future protected areas is to preserve and be representative of the ecoregions and subregions.

Figure 3.7 Location of Ecoregions in Newfoundland and Labrador

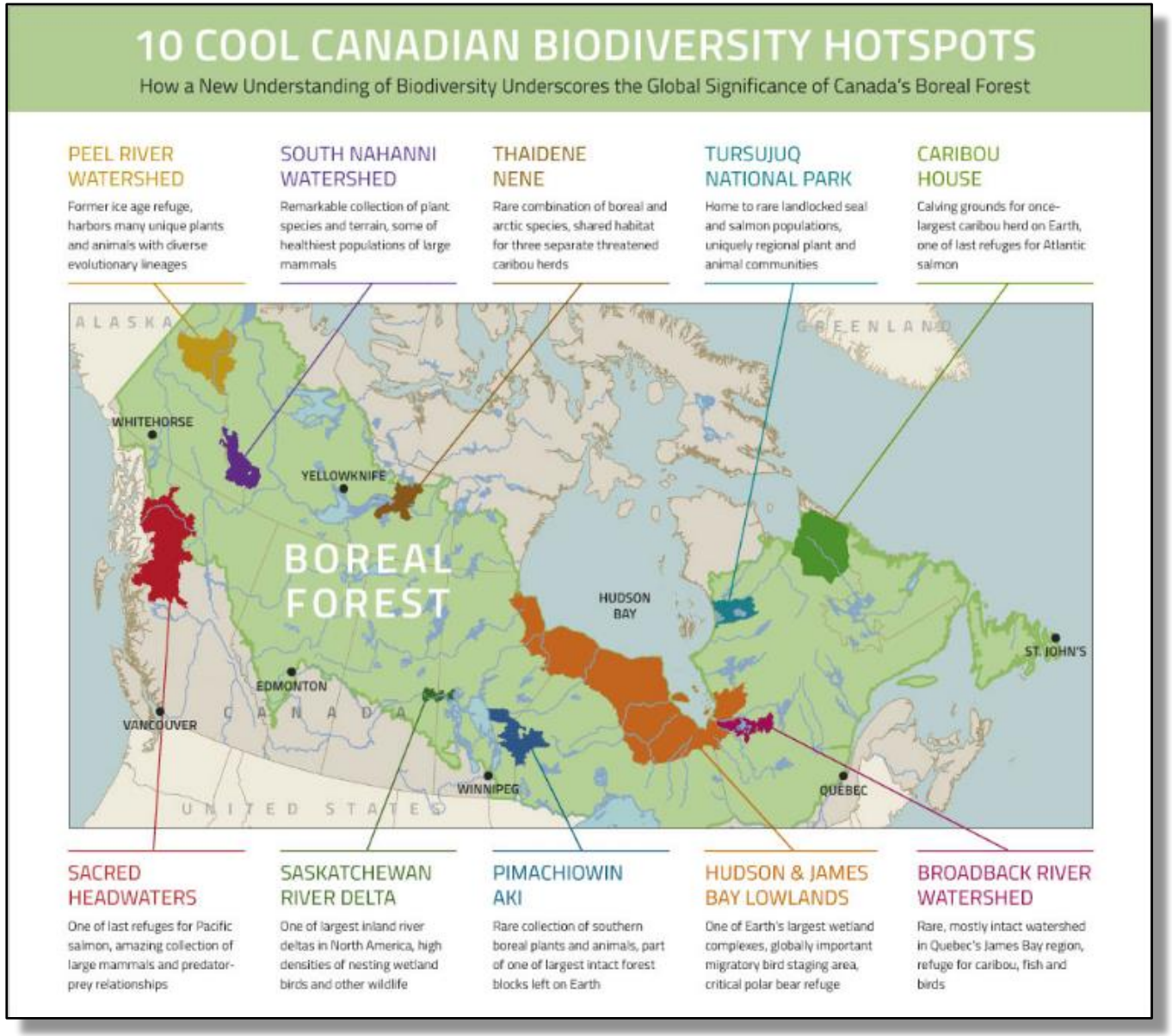


Source: http://www.flr.gov.nl.ca/natural_areas/pdf/ecoregions_nf_lab.pdf

Generally, Canada is endowed with resource rich forests of high level of ecological intactness. The combination of favourable climatic, ecological, soil, geological and human (high overexploitation) factors have created pockets of rich natural heritage spots (biodiversity hotspots) across Canada. This is the indication of the rich natural blend of biodiversity over decades and centuries. Biodiversity hotspots are locations with high number, variability and species richness. 10 biodiversity hotspots across Canada have been identified, as shown in Figure 3.8. The biodiversity hotspot's location and distribution reveal the following underlining factors – remoteness to human population, closeness to water body, latitudinal position towards the north and difference in size. The Caribou House biodiversity hotspot is partly within NL province and it is the breeding ground for one-time largest caribou herds on earth and it is also one of the remaining habitats for Atlantic salmon. These biodiversity hotspots are being managed by various provincial biodiversity conservation policies and the combination of provincial planning and management processes.

Other provincial planning and management processes employed include: Terrestrial Research and Habitat Management (TRHM), Conservation Areas Reporting and Tracking System (CARTS), Environmental Impact Assessment (EIA), Environmental Review Process (ERP) and Wildlife Information Management System (WIMS). The suite of provincial planning processes, information systems and the biodiversity management structure mainly at the provincial level in NL as discussed above, are insufficient and patchy.

Figure 3.8 Biodiversity Hotspots in Canada



Source: http://www.rcinet.ca/en/wp-content/uploads/sites/3/2013/05/map-coolspots1.jpg

There are conscious attempts in the NL province to address the status and trend of biodiversity loss through different plans and strategies which often times are not coordinated and not jointly monitored to achieve the overarching goals of the Canadian National Biodiversity Strategy and the CBD through sub-national strategies. However, it is expected that these provincial planning and management processes are directed towards the NL's S-NBS in order to mainstream and monitor biodiversity concerns through their initiation, development, implementation and review.

CHAPTER FOUR - ANALYSIS AND DISCUSSION OF RESULTS

Previous chapters have discussed the issues of the definition, understanding and approach to biodiversity conservation; the prevailing issues and main drivers of biodiversity loss, the status and loss of biodiversity; the existing biodiversity conservation framework and challenges in the province of NL, Canada. This chapter attempts to discuss specific issues such as the absence of a S-NBS and framework in NL; the probability of not meeting the Aichi Target 11 in 2020; justification for the introduction of best practices from the UK; and structural failures and lapses in biodiversity policy coordination, monitoring and reporting in NL in more details.

4.1 Absence of Newfoundland and Labrador Sub-National Biodiversity Strategy (S-NBS)

The 0.5% reduction in budgetary allocation to biodiversity policy and priorities between 2014-2015 to 2016-2017 (Environment and Climate Change Canada, 2017c) is an indication of the lack of Canadian Government's commitment to biodiversity issues (see Appendix 3 for more details on reduction in budgetary allocation and performance management). In the light of the above, only 6 out of 13 provinces and territories have developed their own biodiversity strategies and action plans. Therefore, the availability of Sub-National Biodiversity Strategies and Action Plans is inadequate because this is about 46% achievement rate for developing sub-national strategies across Canada. NL province does not have a S-NBS but has sub-national biodiversity websites. Figure 4.1 below shows the status of NL and other provinces and territories of Canada in this regard. The NL Sub-National Biodiversity website contains disjointed biodiversity related policies aimed at addressing biodiversity related issues.

Table 4.1 – Existence of Sub-National Biodiversity Strategy and Action Plan in Provinces and Territories of Canada

Provinces and Territories	Sub-National Biodiversity Strategy	Sub-National Biodiversity Websites
Alberta	No	Yes
British Columbia	No	Yes
Manitoba	Yes	Yes
New Brunswick	Yes	No
Newfoundland and Labrador	No	Yes
Nova Scotia	Yes	Yes
Ontario	Yes	Yes
Prince Edward Island	No	Yes
Quebec	Yes	Yes
Saskatchewan	No	Yes
Northwest Territories	Yes	Yes
Nunavut	No	No
Yukon	No	Yes

Source: Biodivcanada (2015)

The implications of the absence of a S-NBS in NL are: that there is no clear leadership, direction and commitment of the Provincial Government; lack of opportunities for planning and negotiation across the levels of governance in the province; and coordination, monitoring and reporting requirements which are necessary to meet Canada's biodiversity conservation goals and Canada's commitment to the CBD are not supported.

It is necessary to examine the main thrusts of the existing sub-national strategies in and out of other Canadian provinces in other to establish how they are meeting the requirements, whether they are "fit for the purpose" and to justify their adoption as best practice in NL. This necessitate the application of UK biodiversity best practices.

Available evidence on S-NBSs in other Canadian provinces and territories shows in all intent and purpose that they were developed to enhance the implementation of the CBS and achieve its outcomes. The sub-national biodiversity strategies' scope (ecosystems, species, and genetic resources), vision, guiding principles (multiple values, stewardship public participation, integrated planning and knowledge and precaution) and management outcomes are intended to address biodiversity loss. They all focus on an ecosystem approach but with different biodiversity goals. The New Brunswick biodiversity model's goals are conservation of the genetic, species and ecosystems and sustainable use and development; Nova Scotia model's goals are collaborative leadership, sustainable resource development, research and knowledge sharing and good governance; and Quebec model's goals are conserving biodiversity and maintaining ecological services, development without irremediable prejudice to biological diversity and ecological services, acquisition and sharing knowledge on biodiversity and ecological services. As it can be seen, the provincial strategies goals are not uniformly structured and present a great deal of mix-match with regards to policy coordination, monitoring and information management.

The implications of these commonalities and divergences in the main thrusts of these sub-national strategies would result in differential management outcomes, monitoring and reporting. Hence, the need for a unifying approach to address the issues identified in the 2020 Biodiversity Goals and Targets for Canada and the CBD goals. In addition, 'muddling through' due to time constraints to meet international targets (such as the Aichi Target 11 in 30 months) would create ad hoc biodiversity strategies through a haphazard approach to policy development. This is

the main justification for the proposal to introduce the UK best practices in biodiversity conservation in NL.

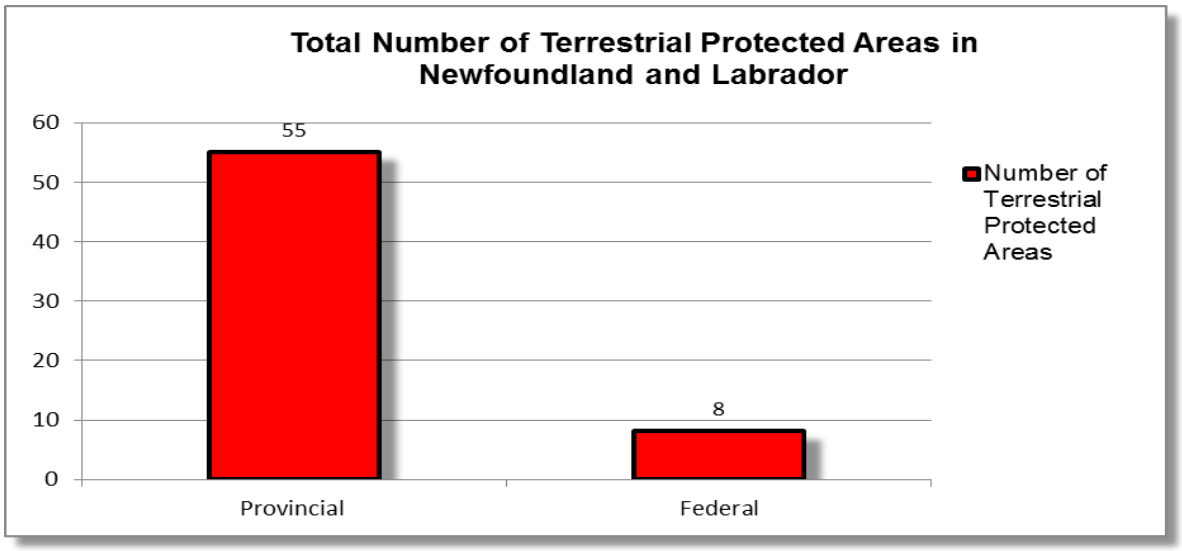
4.2 Achieving the 2020 Biodiversity Goals and Targets for Canada and the Aichi Target 11 in 2020

International targets are set to guide CBD signatory countries to strive to meet the broad goals of the CBD. Aichi Target 11 aims to monitor the conservation of biodiversity. Signatory countries are to designate 17% of their land area as TPL and 10% of their ocean as MPA.

The National Terrestrial Protected Land (NTPL) average in Canada as at 2003 was 8.52% (The Government of Newfoundland and Labrador, 2017d). This percentage has increased, as at 2015, "10.6% (1.05million km^2) of Canada's terrestrial area (land and freshwater), and 0.9% (51 thousand km^2) of its marine territory" has been considered protected (Environment and Climate Change Canada, 2016:5). In NL, there are 63 TPAs out of which 55 are managed by the Provincial Government and the other 8 are managed by the Federal Government (see Figure 4.1 below for the frequency distribution of the type of protected areas).

The total area of NL is 345,720km^2 and percentage of terrestrial land protected is 7.72% and 3.33% respectively as previously presented in Table 3.2 (The Government of Newfoundland and Labrador, 2017d). This reflects a deficit in the provincial TPL area and MPA of 12.48% and 9.5% respectively. Table 4.2, Figures 4.2 and 4.3 describe the type, number, percentage of the province's protected land under different jurisdictions and the expected (Aichi Target 11). There are more number of TPAs under the management of NL provincial government while their areal coverage is 35% compared to 65% of the total TPAs in the province managed by the federal government.

Figure 4.1 – Type of Terrestrial Protected Areas in Newfoundland and Labrador



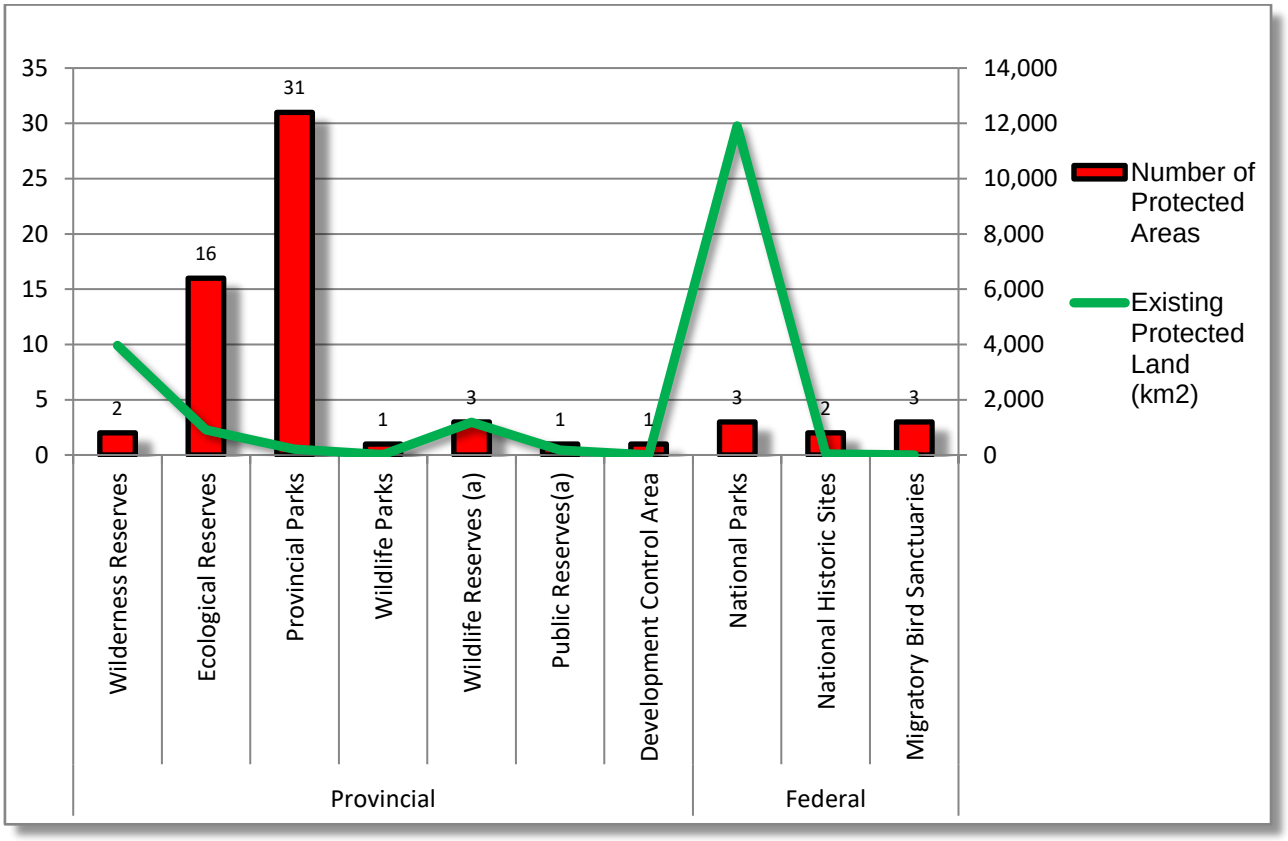
Source: The Government of Newfoundland and Labrador, (2017d)

Table 4.2 Type, Number, Existing and Aichi Target 11 Province Protected Land

Jurisdiction	Types of Protected Area	Number of Protected Areas	Existing Protected Land (km^2)	Aichi Target 11 - Province Protected Land (km^2)
Provincial	Wilderness Reserves	2	3,965	14,913
	Ecological Reserves	16	910	3,423
	Provincial Parks	31	211	794
	Wildlife Parks	1	15	56
	Wildlife Reserves [(a)]	3	1,183	4,449
	Public Reserves[(a)]	1	178	669
	Development Control Area	1	1	4
Federal	National Parks	3	11,906	44,779
	National Historic Sites	2	37	139
	Migratory Bird Sanctuaries	3	0	4
Total		63	18,405	69,222

Source: The Government of Newfoundland and Labrador, (2017d)

Figure 4.2 Number and Type of Protected Areas in Newfoundland and Labrador

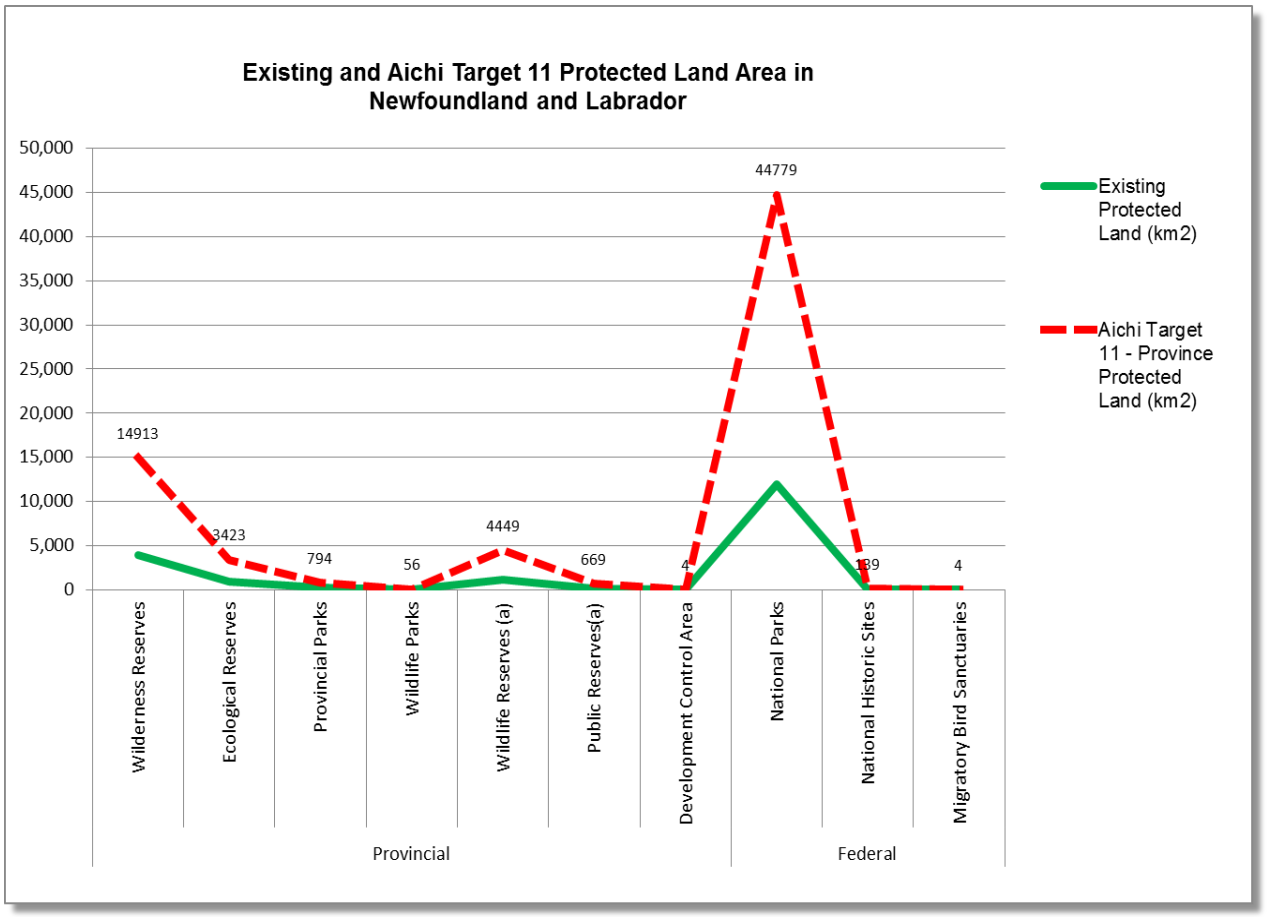


Source: The Government of Newfoundland and Labrador (2017d)

Available evidence as stated in Figure 4.2 above reveals that there are more provincial parks (31) and ecological reserves (16), while the national parks (3) have the largest areal coverage in NL province. The implication of the scenario above is that the NL provincial government should increase the percentage of protected areas' areal coverage either by expanding the existing protected areas or designating new protected areas.

The scenarios described in these tables and figures present a critical situation for biodiversity conservation in NL. Aside from the absence of a S-NBS at the provincial level, the provision and status of protected areas (terrestrial and marine) are far from meeting the Aichi Target 11 in 2020 (30 months' time).

Figure 4.3 Existing, Number and Type of Protected Areas in Newfoundland and Labrador



Source: The Government of Newfoundland and Labrador (2017d).

There is an imbalance in the mix of these protected areas which consist of mainly national parks, but very few migratory birds' sanctuaries. Consequently, a provincial protected area deficit of 69,222km^2 as stated in Table 4.2 and Figure 4.3 above needs to be met in NL province before 2020. This deficit is due to the combination of factors such as historic failure to meet the CBD 2010 targets, lack of NLS-NBS and framework, conflicting forest-agriculture management policies, and substantial dependence on mining industry (oil and gas investments) in the last two decades.

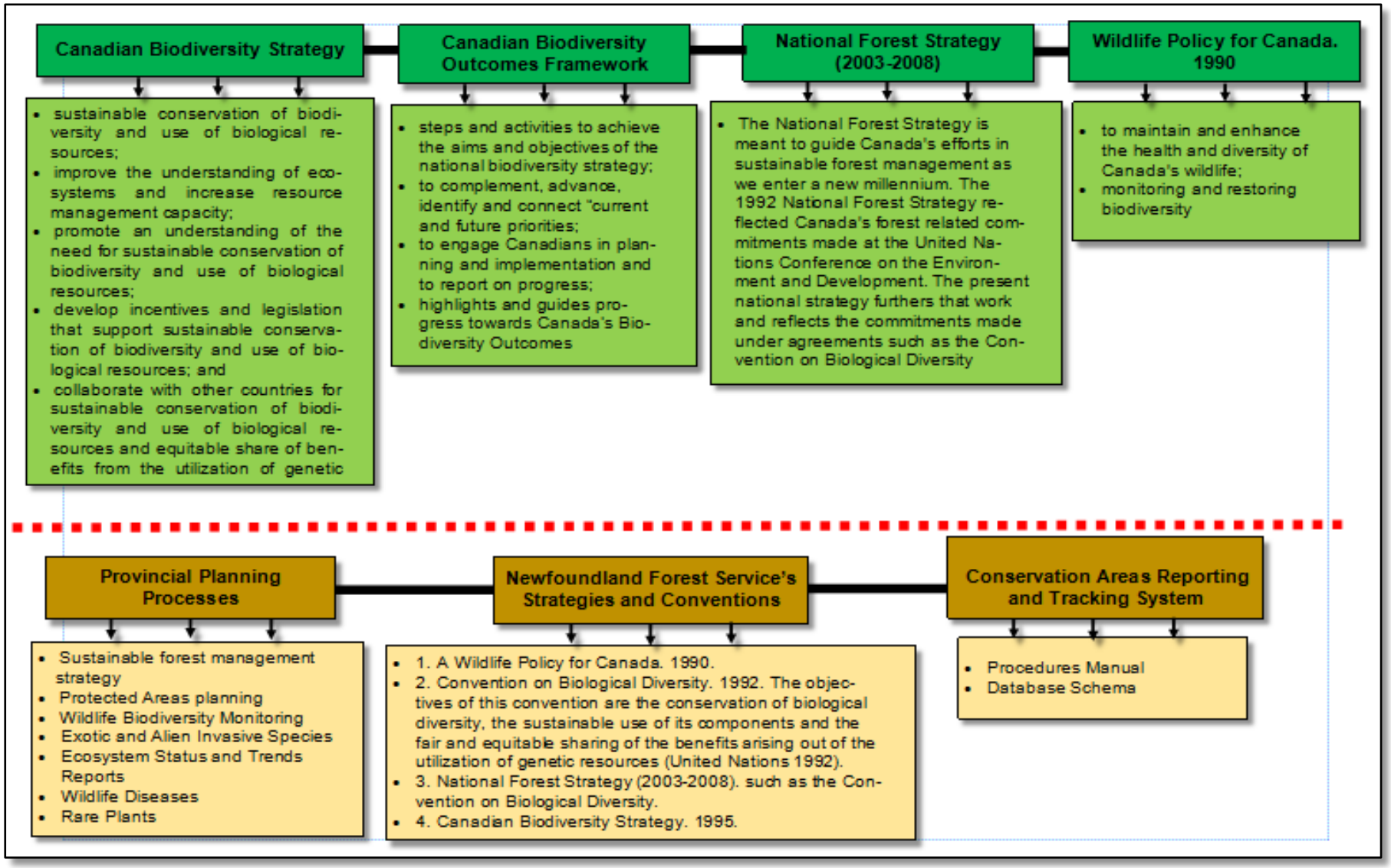
4.3 Newfoundland and Labrador Sub-National Biodiversity Strategy Framework

The existing biodiversity related policy structure indicating policies and their associated goals in NL, as shown in Figure 4.4 below, presents a two-tier jurisdictional (Federal and Provincial) structure. Apart from the fact that it does not have a developed S-NBS, the policies are not well connected to create the synergy for effective implementation, credible outcome- based evaluation and review. Hence, the achievement of the Canadian Biodiversity goals failed in 2010 and it is possible to fail in 2020 due to the magnitude of milestones to overcome within 30 months from now.

The existing biodiversity policies in UK have been considered best practices on biodiversity conservation over many years (DEFRA, 2015; WSP-Parsons Brinckerhoff, 2016). The biodiversity strategies and plans are structured in three level of governance (Europe, UK and local). The hierarchical structure enhances effective policy drafting, implementation, evaluation and review and achievement of results and targets. The biodiversity policy structure addresses policy coordination, monitoring and information sharing to enhance effective, efficient and fair policy decision making. Figure 4.5 shows the suite of UK biodiversity policies and strategies at the local, national and international levels.

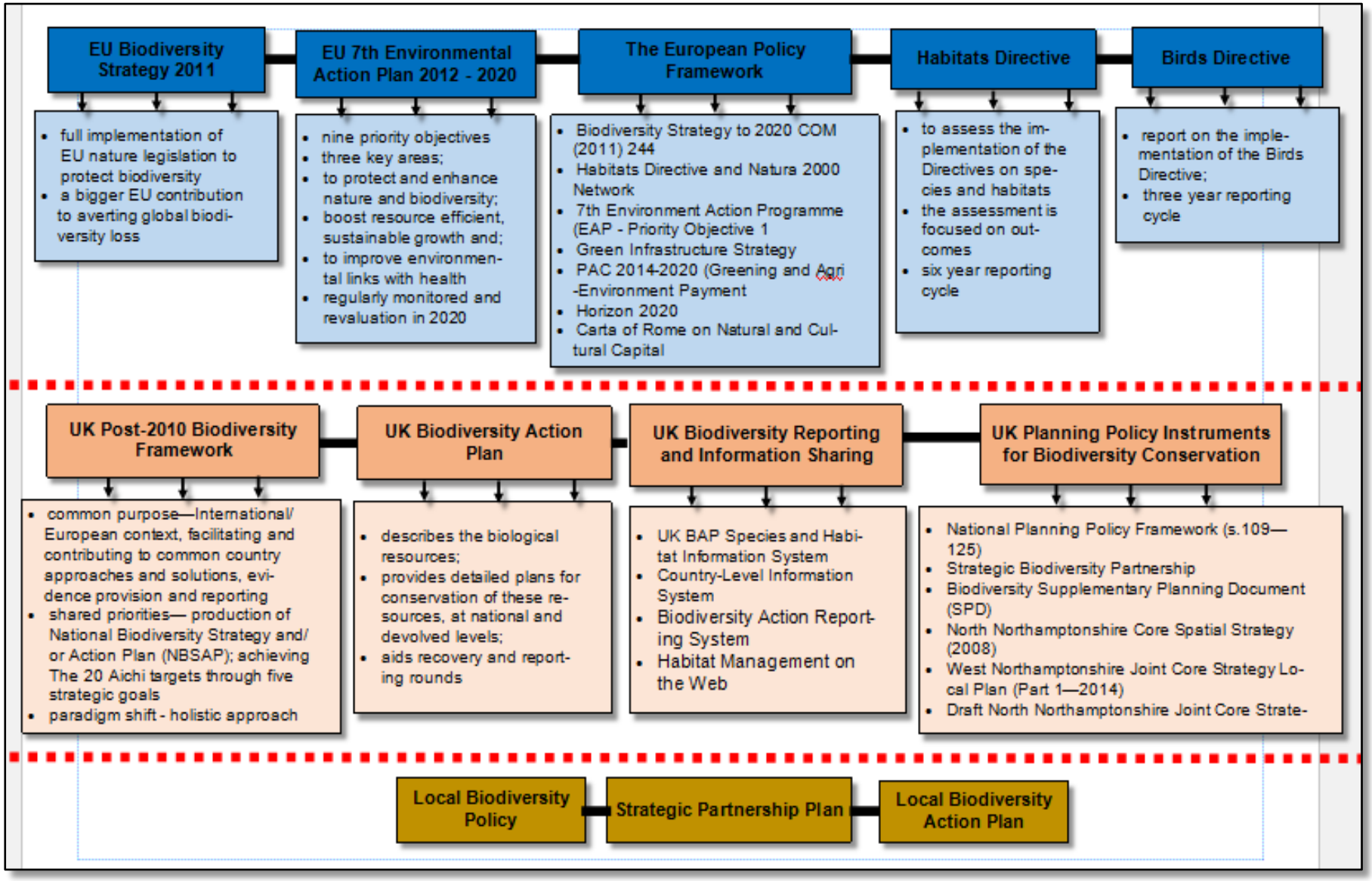
The absence of a NL Sub-National Biodiversity Strategy (NLS-NBS) and the need to coordinate, plan and report on the status and trend of biodiversity in NL have all contributed to the need to propose the establishment of a NLS-NBF. This framework is designed to support/guide the drafting of a NLS-NBS which would reflect the goals of the CBS, NL province's peculiar and articulated biodiversity issues and concerns to meet established targets (Aichi Targets and other specific targets) and commitments (Canada and CBD).

Figure 4.4 - Biodiversity Related Policy Structure in NL Province and Canada



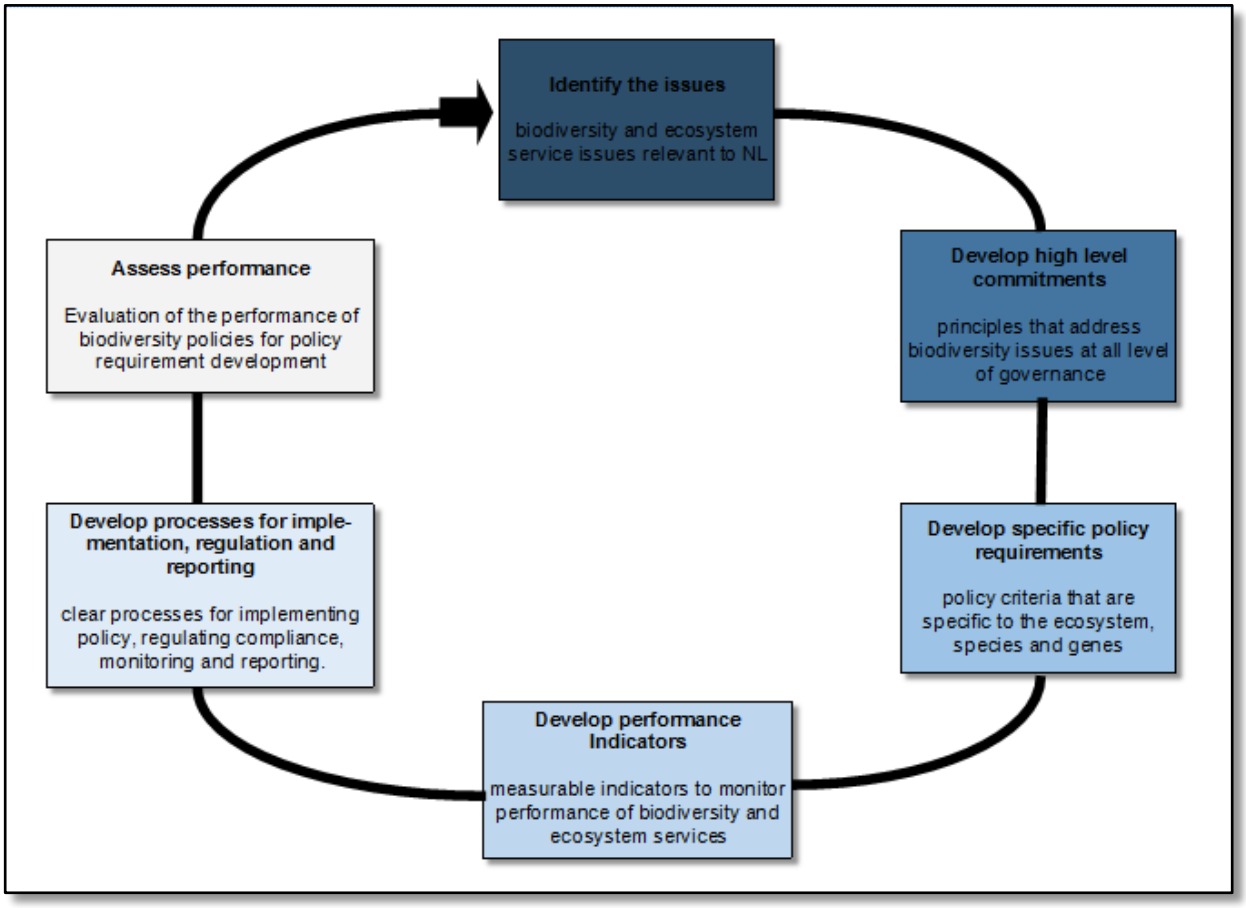
Source: Figure compiled by the author using information from government sources (Biodivcanada, 2015; Minister of Environment and Climate Change, 2016a; The Government of Newfoundland and Labrador Province (2017a).

Figure 4.5 - Biodiversity Related Policy Structure in United Kingdom and Europe



Source: Figure compiled by the author using information from government sources (JNCC and Defra, 2012; Joint Nature Conservation Committee, 2015; European Commission, 2015; European Union, 2015).

Figure 4.6 – Biodiversity Policy Development Cycle in NL



Source: Figure compiled by the author using information from government source (The Government of Newfoundland and Labrador, 2017g)

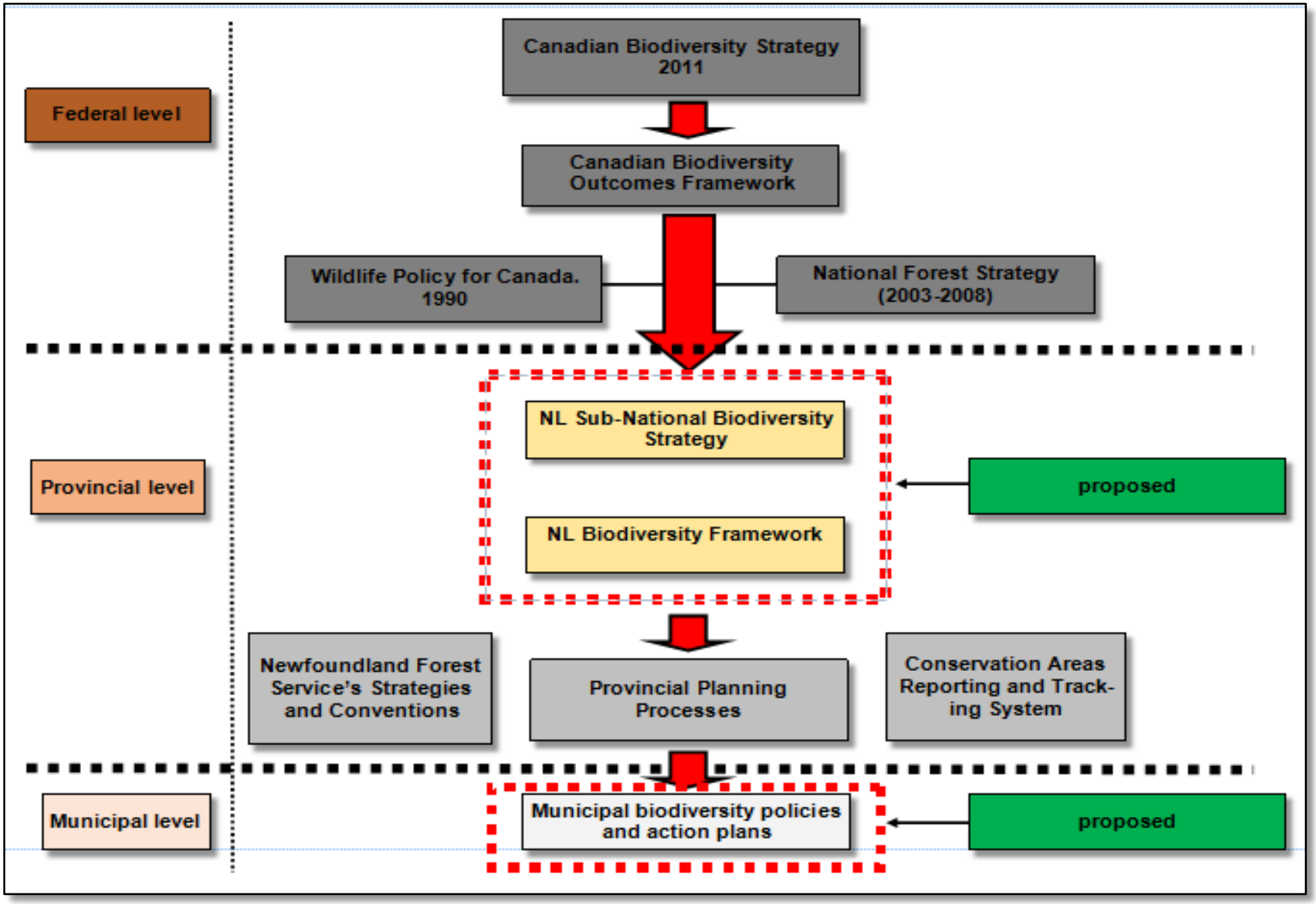
The proposed framework is embedded in the analytic framework of a policy cycle and Figure 2.1 earlier presented (in the second chapter) shows the sequence of activities in the policy cycle which need to be accomplished. The NLS-NBF, as shown in detail in Figures 4.8 and 4.9 below, adopts a policy cycle. This policy cycle is initiated by the identification of issues by consulting individuals, stakeholders, businesses and government agencies, to developing policy, to evaluating policy performance and policy review as shown in Figure 4.6 above.

In view of the above scenarios, both within and outside NL, they present good basis, platform and opportunity to advance biodiversity conservation policy management approach to achieve the goals of the CBS, 2020 Biodiversity Goals

and Targets for Canada, CBD goals and specific (Aichi) targets. Hence, the need for a NL biodiversity framework to guide the implementation of biodiversity strategy in NL. However, the biodiversity framework would be a result of thorough consultation and rigorous engagement of the citizenry, businesses, government agencies and other stakeholders in NL.

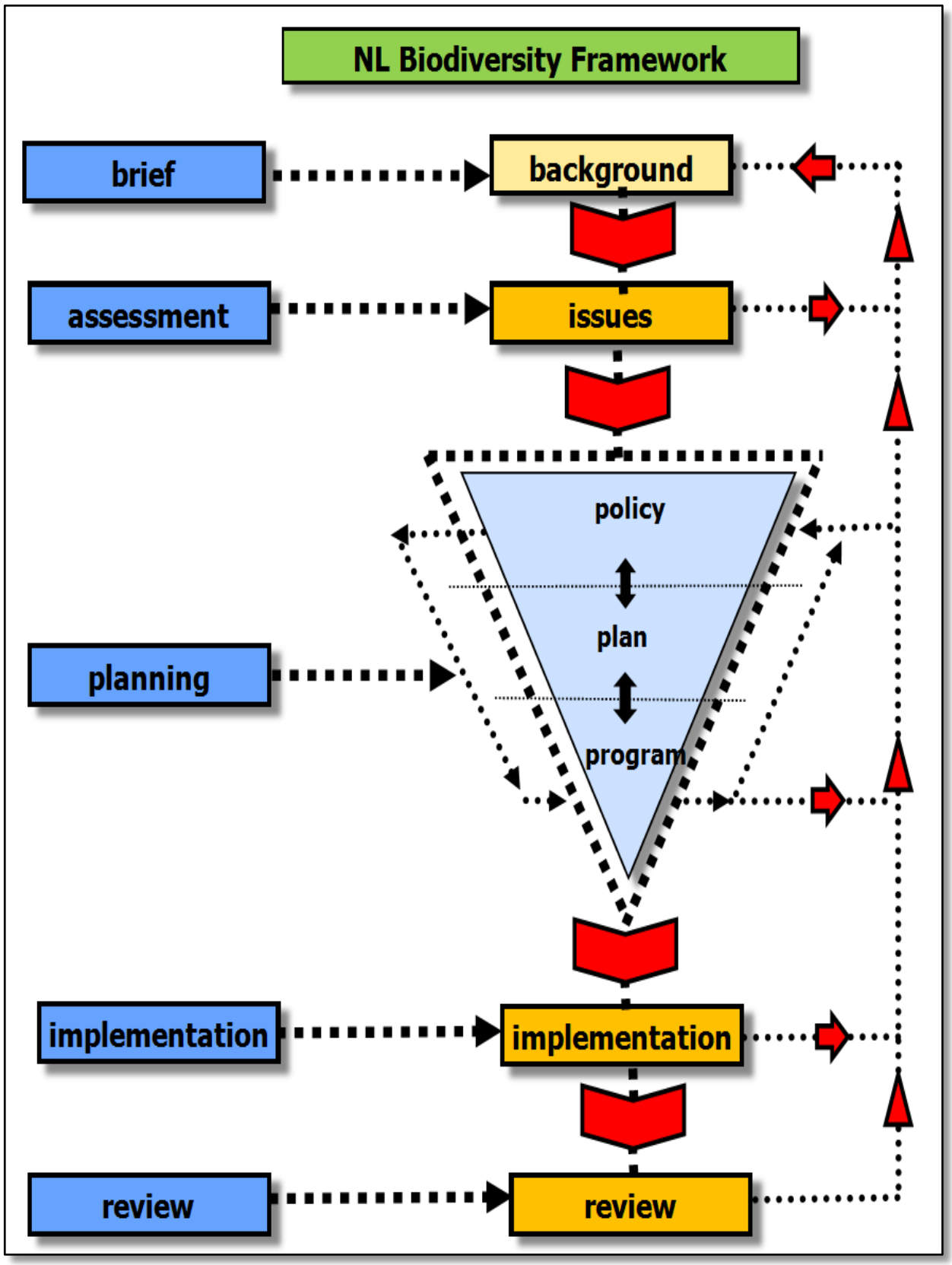
The proposed biodiversity framework highlights the key issues of biodiversity loss and other issues highlighted in the literature review and in the biodiversity policy cycle below. It also focuses on human-induced impacts such as habitat disruption, unsustainable use of resources, mining and energy, large-scale agriculture (cattle rearing), or overfishing which often transcend across sectors and borders (national and regional). The framework focussed on the key issues across NL and Canada as explained in the detailed policy cycle (Figure 4.9) which include Habitat Protection, Protected Areas and Priority Conservation Areas (Environment and Climate Change Canada, 2016; Government of Canada, 2015). Figure 4.7 presents a schematic diagram of the existing and proposed biodiversity related policies in NL, Canada. It reveals a three-tier level of biodiversity conservation and the policy gaps (the proposals - NLS-NBS, NL Biodiversity Framework and Municipal biodiversity policies and action plans) that need to be filled. In the same manner, Figures 4.8 and 4.9 present the NL biodiversity framework and a detailed biodiversity policy cycle which identifies the main drivers and issues, specific policy criteria (plans and program), implementation and management approach (coordination and monitoring and information sharing) and policy review.

Figure 4.7 - Schematic Diagram for the Existing and Proposed Biodiversity Related Policy Gaps in NL, Canada



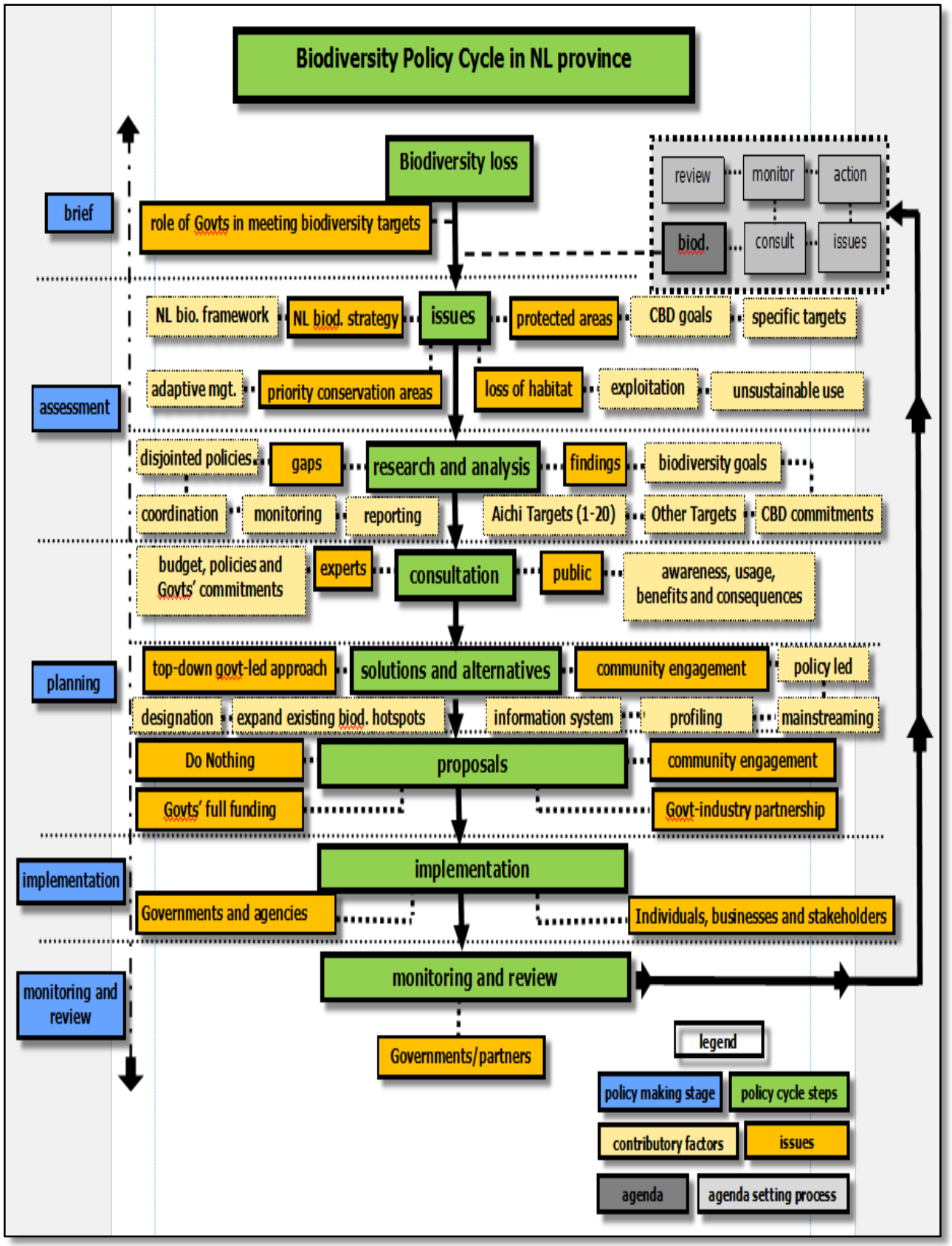
Source: Figure compiled by the author using information from government sources (Biodivcanada, 2015; Minister of Environment and Climate Change, 2016a; The Government of Newfoundland and Labrador Province (2017a).

Figure 4.8 – Newfoundland and Labrador Biodiversity Framework



Source: Figure compiled by the author using information from government sources (The Government of Newfoundland and Labrador, 2017g; The Government of Newfoundland and Labrador Province (2017a).

Figure 4.9 – Newfoundland and Labrador Biodiversity Policy Cycle



Source: Figure compiled by the author using information from government sources (The Government of Newfoundland and Labrador, 2017g; The Government of Newfoundland and Labrador Province (2017a).

The framework crystalizes the broad concept of considering the background and baseline information as the brief which gives clear understanding of the main issues of biodiversity loss in NL. This is the WHAT phase in the biodiversity framework. The assessment stage addresses the WHY phase where the rationales of the issues are understood and lead to the planning stage. At the planning stages, issues are addressed by drafting policies which develop into plans and are carried out in programs. Finally, the implementation and review stages summarize the HOW phase of the framework. This is where the framework is actually implemented and monitored for performance. The entire framework loops back to the background and issues stages to make the framework cyclic and continuous. Figures 4.8 and 4.9 give graphical representation of the process described above.

The proposed NL Biodiversity Framework as presented in Figure 4.8 is elaborated further using specific biodiversity issue (biodiversity loss) in Figure 4.9. The NL Biodiversity Policy Cycle discusses biodiversity loss as the identified policy issue with an agenda setting loop and contributory factors (loss of habitat, inadequate protected and priority conservation areas and lack of NL biodiversity strategy. The first two steps form the brief stage of the policy cycle. It proceeds to research and analysis the issues to identify policy gaps and present findings which is the assessment stage. The policy cycle proceeds to the planning stage which involves public and expert consultation on biodiversity, generation of alternatives, solutions and proposals. The preferred proposal is implemented through individuals, businesses and government agencies at the implementation stage. Finally, the monitoring and review stage which involves monitoring biodiversity policy performance for periodic review.

4.4 Jurisdictional Levels of Biodiversity Conservation in NL and UK Best Practice

The existing jurisdictional level is a two (federal and provincial) tier hierarchical structure as shown in Figure 4.5 where biodiversity related polices seat only at the Federal and Provincial jurisdictional levels creating a vacuum at the municipal level. It is evident from the existing structure that management approach to biodiversity loss is not reflected at the local (municipal) level in NL. The proposed structure reflects a three-tier hierarchical structure with identified gaps at the provincial and municipal levels as shown in Figure 4.7.

The implications of this scenario are that biodiversity concerns at the Federal and Provincial levels do not connect with policy directions and plan making processes and actions of the 271 municipalities (3 cities and 268 towns) in NL; there is no procedural transition in terms of agenda setting and policy focus between the municipalities and NL province; there is an administrative 'blackhole' at the local level vis-à-vis local biodiversity implementation and there is no framework for local biodiversity implementation at the municipal level.

By comparison, the UK strategic spatial planning policy structure has a three-tier hierarchical jurisdiction for biodiversity conservation structure which enhances the flow of policy direction from the international level to the local level. Under the strategic spatial planning concept, the NPPF and PPS 9 stipulate the overarching biodiversity policy goals at the national level supported by the Strategic Biodiversity Policies and Plans (SBPP) at the county level and implemented by the Supplementary Planning Documents (SPD) and the Local Biodiversity Policy (LBP), Local Biodiversity Action Plan (LBAP) at the local level as shown in Figure 4.6. The UK biodiversity conservation structure is integrative and connected and this best practice in biodiversity conservation can be adopted in NL.

4.5 Coordination (Mainstreaming) of Biodiversity Policies in Newfoundland and Labrador

The effectiveness, efficacy and fairness of public policies implementation is largely dependent on how well-coordinated they are with other policies in other industries of the economy. It is evident (Millennium Ecosystem Assessment, 2005:16; Winfield, 2016b) that policy coordination is crucial to good policy implementation. However, biodiversity policy nexus (mainstreaming) is more beneficial to policy development process and sustainable development (Sabau, 2010). Therefore, biodiversity mainstreaming as earlier explained in Chapter 2 is not only a CBD requirement but also at the heart of sustainable development.

The absence of a NL biodiversity strategy and outcome framework underlines a major policy coordination flaw in NL. A cursory look at Figure 4.5 reveals that the disconnection between policy directions within and between jurisdictions presents disjointed and stand-alone policies addressing issues discretely. Hence, the need for cross-sectoral biodiversity mainstreaming in the main provincial industries (manufacturing, agriculture, fishing, pulp and paper, mining and energy).

There is evidence of policy coordination of biodiversity related policies at the Federal level in view of the policy wordings and directions of the Green Action Plan, CBS, Canadian Biodiversity Outcome Framework and the Clean Energy Dialogue Action Plan (2012). On the contrary, the NL Provincial Regional Development Policy, which contains policies on key issues, opportunities and constraints and the directions of new regionalism in the province, does not refer to biodiversity at all. Therefore, there is a lack of direction for biodiversity at the regional level (Vodden *et. al.*, 2014).

Furthermore, a content analysis of biodiversity in the policy wordings of the provincial planning and management processes (Sustainable Forest Management Strategy, Protected Areas Planning, WBM, Exotic and Alien Invasive Species, Ecosystem Status and Trends Reports, Wildlife Diseases and Rare Plants and Greening Government Action) cannot establish 'policy connectivity' as a measure of policy coordination. An analysis of biodiversity issues mainstreaming in the NL Province Development Strategy and in 3 municipalities' (cities – Corner Brook, Mount Pearl and St. John's) plans in the province reveals an overall lack of biodiversity mainstreaming in development plans' general goals, general principles, policies, implementation and review at all jurisdictions in the province, as shown in Table 4.3 below.

Table 4.3 Biodiversity Mainstreaming in Provincial Development Strategy and Municipal Plans

City/Biodiversity Mainstreaming	Mainstreaming Biodiversity Issues				
	General Goals	General Principles	Policies	Implement ation	Review
Provincial Government					6 Years
Corner Brook					5 Year
Mount Pearl					5 Year
St. John's					10 Year

No mainstreaming	
Fair mainstreaming	
Good mainstreaming	

Source: Figure compiled by the author using information from government sources (The Government of Newfoundland and Labrador Province, 2017a; The Government of Newfoundland and Labrador, 2017g).

The implications of the scenarios described above include a general lack of biodiversity policy direction in the province of NL, piecemeal approach to biodiversity conservation, duplication and waste of resources and the inability to meet biodiversity goals (CBS and CBD) and targets (Aichi targets).

Moreso, the lack of dissemination of biodiversity policy ideas and directions from the provincial level to the municipal level is another indicator of the low level of biodiversity mainstreaming. Consequently, the high dependence on mining (oil and gas) and resource based (fishing) industries has resulted in low biodiversity concerns and awareness and low level of biodiversity mainstreaming. This is also reflective of the little or no focus and contents of biodiversity issues in the municipal plans of the 271 municipalities (3 cities and 268 towns) in NL.

The UK best practice for coordination of biodiversity policies is mainstreamed from the national level to the local level in a three-tier structure. The NNJPU model as explained earlier in previous chapters, through a development plan (North Northamptonshire Joint Core Strategy 2011 – 2031) mainstreams biodiversity concerns in planning policies (environment, housing, local economy, agriculture, shopping, transport, green infrastructure, energy, mineral and waste) at the strategic level, connects four local planning authorities to the overarching strategic spatial planning policy goals and coordinates strategic biodiversity conservation initiatives at the local level. These four local planning authorities have individual LBAP and SPD on biodiversity reflecting the goals of the strategic biodiversity policies.

While there is a dearth of information on the development permit process in the municipalities and NL province, a UK best practice for biodiversity considerations in the planning application process is in the NNJPU model. This planning unit

mainstreamed biodiversity issues in the planning policy and planning application permission through Core Spatial Strategy Policy 13. Available evidence about the planning application process reveals that only an annual average of 6 (0.24%) planning applications out of an annual average of about 2450 planning applications over a 7year (2008 – 2015) period were granted contrary to Environment Agency which gives environment related responses and advice. In addition, there were inconsistent changes in areas of biodiversity importance, development permitted within Site of Special Scientific Interest (SSSI), Local Natural Reserve (LNR), within 1km of natural greenspace over the same period. These inconsistencies have direct implications on the status and trend of biodiversity loss. Table 4.4 presents more details of these dynamics.

However, the biodiversity policy coordination (mainstreaming) gap in biodiversity related policies between the tiers of government and across sectors in NL creates a disjointed approach to biodiversity conservation, unnecessary waste and duplication of effort, initiatives and resources, consistent failure to meet goals and targets. Biodiversity mainstreaming involves working with the biodiversity partnership to engage more people, businesses and government agencies in biodiversity issues, promote stewardship biodiversity values in public and private sector decision-making and establishing new and innovative funding. Consequently, a provincial biodiversity strategy with a more integrated large-scale

Table 4.4 North Northamptonshire Annual Monitoring Report – Biodiversity Monitoring Indicators

Monitoring Indicators/Years	CSS Policy	2008-09	2009-10	2010-2011	2011-2012	2012-2013	2013-2014	2014-2015	Total	Average
Applications granted contrary to EA Advice	13	3	0	5	6	6	6	7	46	6
Change in Areas of Biodiversity Importance [ha net designated]	13	209	43.68	-118.53	-65.62	12.95	19.22	-19.34	94	12
Development Permitted Within SSSI or LNR [ha]	13	0	0	6.42	6.81	0	2.7	60.91	90	11
Development within 1km of natural greenspace [%]	5	45	53	56	45	44	49	46.63	344	43

** Annual Average of about 2450 planning applications over a 7 year (2008 - 2015) period*

** Core Spatial Strategy seeks increase in priority habitats and species (targets in BAP)*

** National Planning Policy for Housing (PPS3) sets a national target for provision of new housing on 'previously developed land' (PDL) at 60%.*

Source: Figure compiled by the author using information from government source (North Northamptonshire Joint Planning Unit, 2017).

approach to conservation on land and at sea with detailed action plans in other sectors of the economy is needed to address the lack of effective biodiversity mainstreaming. This reflects “CBD Strategic Plan strategic goal A - address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society” (Department for Environment, Food and Rural Affairs, 2011; Secretariat of the Convention on Biological Diversity, 2012).

4.6 Monitoring (Profiling) Biodiversity Policies in Newfoundland and Labrador

Government departments and agencies at the federal, provincial and territorial level have legal instruments to control access and activities within their jurisdiction. There are legal obligations to develop national strategies and action plans to conserve and use sustainably the biological diversity within their jurisdiction (Secretariat of the Convention on Biological Diversity, 2012). Article 7 of the Convention on Biological Diversity provides the legal rationale for biodiversity monitoring and associated activities, including performance assessment, research and data management (Roberts-Pichette, 1995). These Government departments and agencies have the authority to monitor and report on biodiversity, ecosystem and ecological services. Biodiversity monitoring is necessary for tracking the status and trend of biodiversity loss, assessing biodiversity policy performance and meeting goals and targets.

The existing biodiversity monitoring mechanisms in Canada include the WBM, CARTS, the EMAN, the protocols for forest monitoring (1992), tundra monitoring (1993), the breeding bird survey (1994) and terrestrial arthropod biodiversity sampling (1994) to mention few. All these monitoring initiatives use a data management approach focussed on biodiversity (species) indicators. However, the

municipalities' development plans in NL have little or no procedural monitoring process in terms of planning instruments to monitor progress in biodiversity conservation in NL.

An analysis of biodiversity policy and action plans' monitoring in the NL province's development strategies and in the 3 municipalities (cities – Corner Brook, Mount Pearl and St. John's) plans reveals a general lack of monitoring of biodiversity strategy and targets, as shown in Table 4.5 below.

Table 4.5 Biodiversity Monitoring in Provincial Development Strategy and Municipal Plans

City/Biodiversity Monitoring	Monitoring Biodiversity Policies				
	General Goals	General Principles	Policies	Implement ation	Review
Provincial Government					6 Year
Corner Brook					5 Year
Mount Pearl					5 Year
St. John's					10 Year

No monitoring	
Fair monitoring	
Good monitoring	

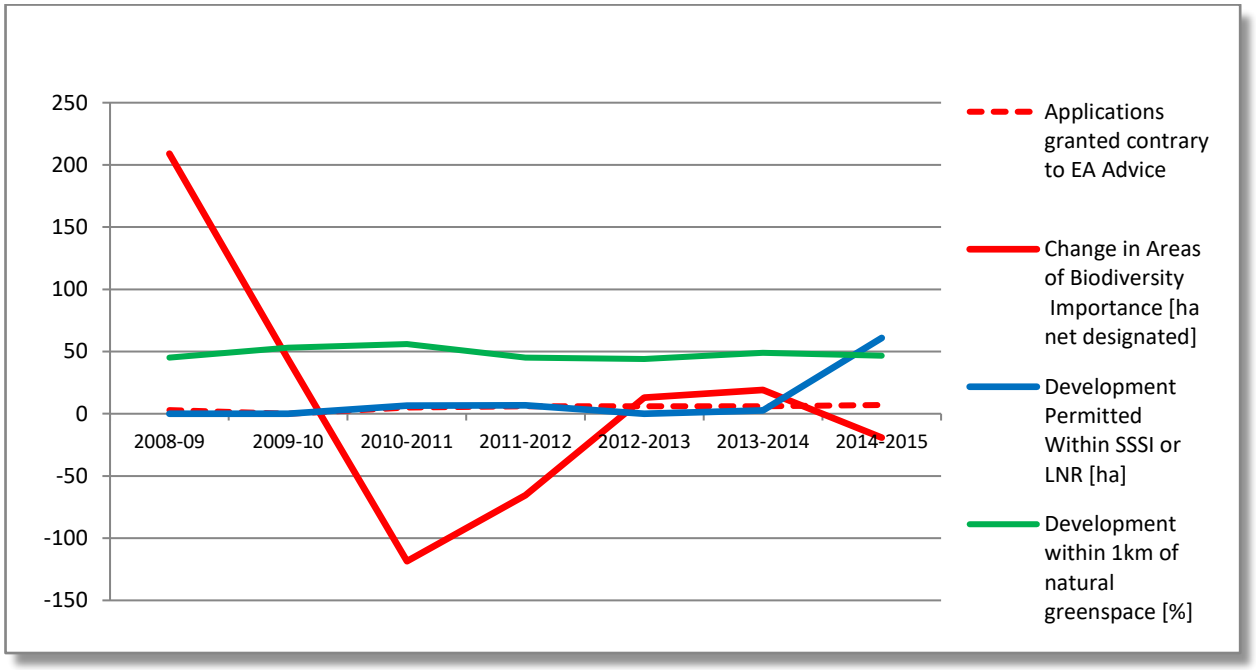
Source: Figure compiled by the author using information from government sources (The Government of Newfoundland and Labrador Province, 2017a; The Government of Newfoundland and Labrador, 2017g).

The implications of the scenarios described above include a general lack of biodiversity policy monitoring in NL province, a dearth of or lack of biodiversity data for baseline information for biodiversity decision making, inability to track the status

and trend of biodiversity loss and the inability to measure biodiversity policy performance and failure to meet the 2020 Biodiversity Goals and Targets for Canada and the CBD commitment of information gathering and knowledge sharing. This will ultimately impede data gathering to formulate policy with respect to biodiversity conservation and sustainable resources management in NL and Canada.

While there is a dearth of information on biodiversity policies monitoring through the development permit process in the municipalities and NL province, a UK best practice for biodiversity policy monitoring in the planning application process is in the NNJPU's Annual Monitoring Reports (AMR). This planning unit monitors biodiversity issues in the planning policy and planning application permission process through the AMRs. Available evidence about the planning application process as stated in the AMRs (2008 – 2015) revealed about 99.76% success rate of biodiversity policy implementation as against a 0.24% failure rate over this 7year (2008 – 2015) period. Figure 4.10 provides more details about the different biodiversity related monitoring indicators and the temporal analysis of their changes.

Figure 4.10 – North Northamptonshire Annual Monitoring Report – Biodiversity Related Monitoring Indicators



Source: Figure compiled by the author using information from government source (North Northamptonshire Joint Planning Unit, 2017).

4.7 Biodiversity Information System (GIS application) Framework (Biodiversity profiling) in Newfoundland and Labrador

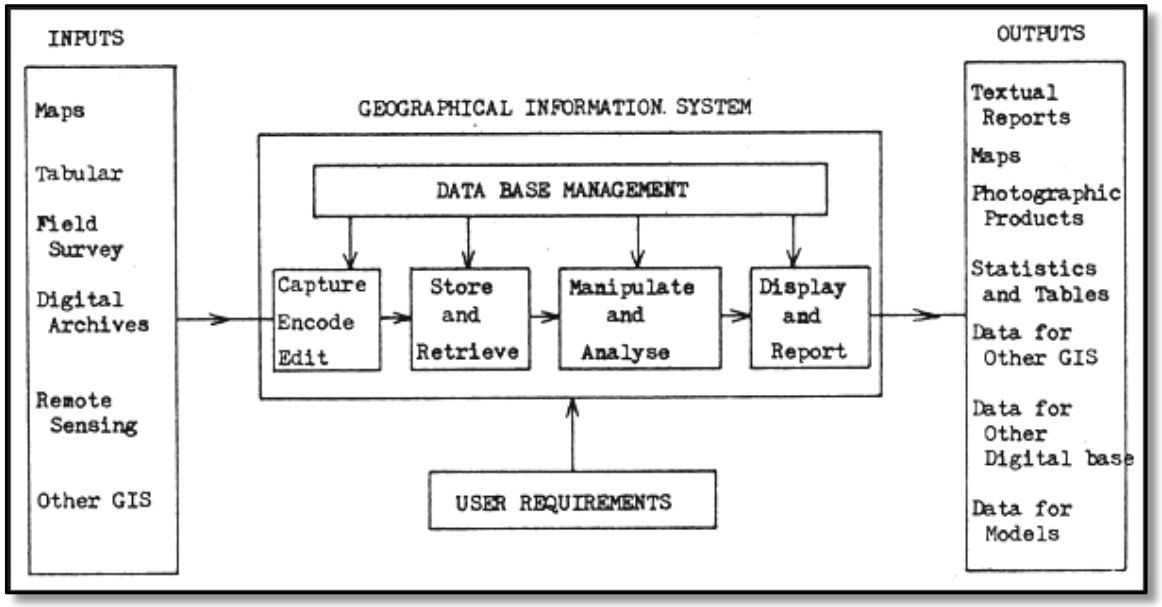
The existing information systems in NL focus on arbitration (Arbitration Awards Database), collective agreement (Collective Agreement Database), Community Infrastructure Mapping System (CIMS), Community Accounts (CA), Resident Wildlife Information Management (RWIM) and WBM. These information systems do not specifically collect, analyse, manage biodiversity data to provide baseline information to monitor the status and trend of biodiversity loss, achievement of biodiversity goals and local and international targets and for biodiversity conservation policy decisions. Hence, there is need for a NL Biodiversity Information System (NLBIS).

The proposed NLBIS development framework involves capturing geo-coded data, developing database structures to store and recover such data, developing

appropriate means to manage and analyse spatial referenced data and producing tabular reports and maps to present the spatial referenced information. Figures 4.11 and 4.12 show the Systems Diagram of GIS and the Biodiversity Information System Development Framework for NL province respectively.

The System Diagram of GIS describes the schematic process and the fusion of various contributors to the process. It typifies the basic entities and processes (input, system and output). This schematic diagram developed by FAO is applied to develop the framework for NL biodiversity information system, as shown in Figure 4.11.

Figure 4.11 - Systems Diagram of GIS



Source: http://www.fao.org/docrep/003/t0446e/T0446E07.htm

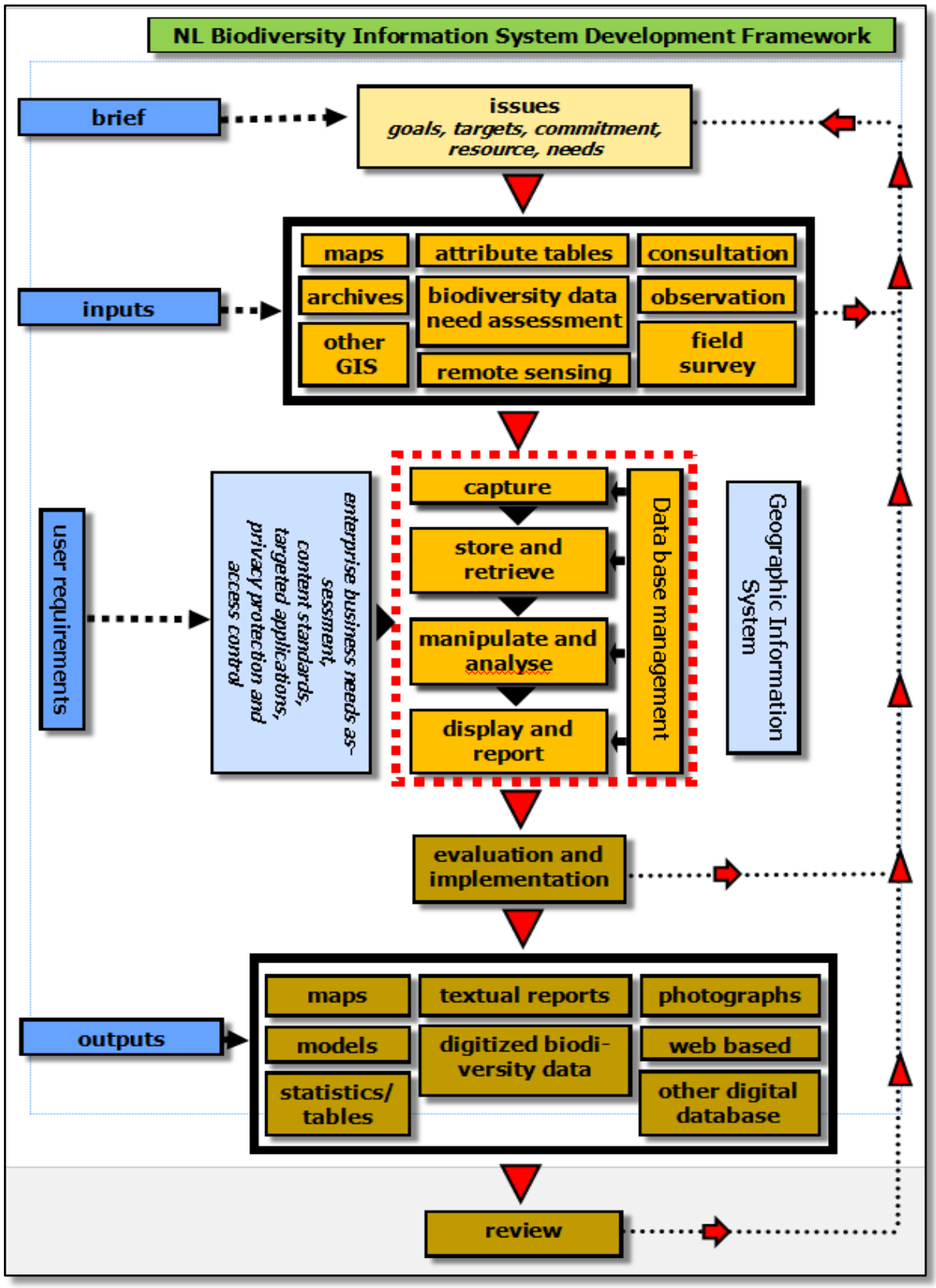
The proposed NL biodiversity information system framework is potentially able to contribute towards the development of a NL biodiversity strategy and action plans. The framework identifies the biodiversity issues (goals, targets, commitments, resources and needs), considered inputs to the framework such as

users' consultation, biodiversity data need assessment, field survey and general observation and specifies the GIS structure and the user requirements. The framework also identifies the expected outputs (maps, statistics/tables, reports, digitized biodiversity data etc.) and review of the outcomes of the framework, as shown in Figure 4.12.

The implementation of the NL biodiversity information system development framework is demonstrated by developing a GIS application project. The GIS application used ArcMap 10.4 software to initiate, capture, store and retrieve, manipulate and analyse data and display and report. The application utilized existing NL map bases, other digitized data and created attribute data on the % of protected terrestrial area, % of protected marine area, populations of species at risk, retention, restoration and management of wetlands, biodiversity considerations are integrated into municipal planning and activities, adaptation to climate change and priority adaptation measure, sustainable forest management and other 2020 Biodiversity Targets. These attribute data in the GIS project are designed to meet the 2020 Biodiversity and Aichi Targets and generate statistics and tables to meet reporting requirements.

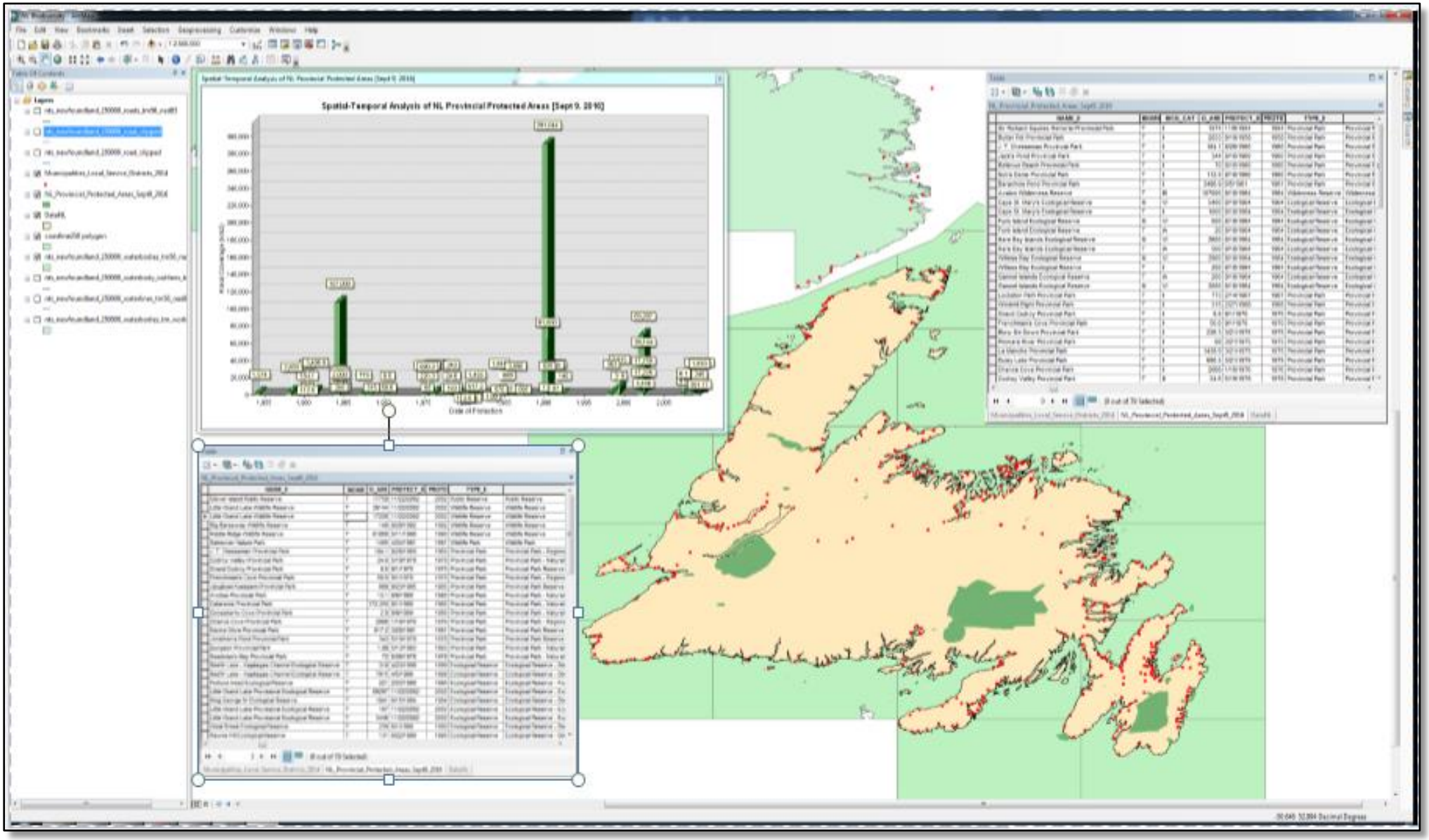
Figure 4.13 shows the result of the GIS analysis of the type, areal coverage and date of protection of protected areas in NL, which reveals the types, number and location of protected areas in the municipalities. The analysis also reveals that there were three peak periods (1965, 1990 and 2003) in the amount of land designated as protected areas between 1955 and 2010. Historically, the largest amount of land was designated as protected area in 1990 and since then there has been significant reduction in the amount of land designated as protected areas. This scenario underlines the prevailing situation where the percentage of land protected in NL is

Figure 4.12 Proposed Biodiversity Information System Development Framework for NL province



Source: Figure compiled by the author using information from government source (FAO n.d., from http://www.fao.org/docrep/003/t0446e/T0446E07.htm).

Figure 4.13 GIS Analysis of the Type, Areal Coverage and Date of Protection of Protected Areas in NL Province



Source: Figure compiled by the author using information from source (GIS Laboratory, Memorial University of Newfoundland [accessed 30 May 2017].

4.52% compared to the Canadian average of 8.52% as stated in the previous chapter.

Based on the results of the analysis, which describes the status and trend of biodiversity loss in terms of lack of biodiversity policy coordination and monitoring and the dearth of biodiversity data in a structured information system, this research will suggest some policy recommendations to address the identified biodiversity issues.

CHAPTER FIVE - POLICY RECOMMENDATIONS AND CONCLUSION

5.1 Introduction

The management of resources in the environment is becoming increasingly important in recent decades. This scenario is complicated by human induced activities and environmental challenges which stretch the utilisation and carrying capacity of these resources resulting in global decline in biodiversity. This research considered the main drivers of biodiversity loss; assessed the prevailing biodiversity conservation practice in NL while citing UK best practice; identified biodiversity challenges in biodiversity policy coordination, monitoring and information-sharing; and assessed local biodiversity policy implementation as compared with overarching biodiversity policies and strategies.

5.2 Policy Recommendations

This research suggests some recommendations in order to address the main issues of biodiversity loss, to develop an effective biodiversity conservation framework, to establish better management (procedural and infrastructural) capacity for biodiversity conservation and to meet local and international commitments. This research provides guidelines for initiating the development (drafting) of a NLS-NBS and action plans. In addition, it suggests that biodiversity considerations should be integrated in all policies/plans concerning the environment, housing, local economy, agriculture, shopping, transport, green infrastructure, energy, mineral and waste, in a cross-sectoral manner. This includes the articulation of preferences through broad public consultation to enhance social

acceptance by the residents, businesses, government agencies and other stakeholders.

Similarly, biodiversity concerns should be considered in the NL Provincial Regional Development Policy at the provincial level and joined-up with the Municipal Plans at the municipal level. The broad goal, principles and indicators of biodiversity conservation should be introduced in the next review phase of these development policies and plans at municipal and provincial levels to boost biodiversity policy coordination, to enhance biodiversity mainstreaming and monitoring and meet biodiversity targets in all jurisdictions.

In addition, the dearth of biodiversity data should be addressed through structured and organised data collecting, analysis, monitoring and management towards the establishment of municipal and provincial biodiversity information systems. The main goal of such an information system is to develop a yearly local biodiversity index. This involves implementing the GIS Enterprise Planning Process [need assessment - conceptual design - physical design – implementation – system management] focussed on habitat protection, designation and preservation of protected areas and priority conservation areas.

The Municipal and Provincial Governments should develop local biodiversity targets. These local biodiversity targets should be included in the municipal plans and in the provincial development policy and strategy respectively. These targets should be material planning considerations in determining development proposals, their performance should be monitored and reported in the AMRs.

Furthermore, the enhancement and strengthening of existing biodiversity hotspot [Caribou House biodiversity hotspot partly within NL]. The Municipal and Provincial Governments should apply an ecosystem approach to develop action

plans to encourage the establishment of biodiversity hotspots and business parks in order to increase the percentage of protected land in the municipalities and NL province respectively, to meet Aichi Target 11 by 2020.

The economic value of NL biodiversity should be harnessed to generate income, create employment (ecotourism) and improve living standards (nearness to nature), by integrating biodiversity conservation in regional economic development (budgetary allocation and GDP contribution) at the provincial level. This economic concept of biodiversity value should be replicated at municipal level in a micro-economic scale.

5.3 Conclusion

This research has discussed the main challenges of local biodiversity policies implementation in NL. It has proven that the province is challenged by uncoordinated policies and improperly monitored policy targets, initiatives and programmes concerning biodiversity preservation due to the absence and lack of monitoring. It has applied the concept of planetary boundaries to articulate effective interaction and efficient interdependence of biodiversity management systems through transdisciplinary approach. This research identified biodiversity loss as a global problem and emphasized the need for effective coordination and proper monitoring of biodiversity conservation (Tillman, 2000) and of an efficient biodiversity information system to calculate a yearly biodiversity index at the local level.

Finally, this research has provided support for the debate for relevant theories, transdisciplinary approach and appropriate methodology in biodiversity management research. The research has identified policy gaps and has suggested

best practices to address the main challenges of local biodiversity policy implementation. The research identified knowledge gaps that existing literature discussed human interaction with biodiversity, the exploitation (access, use and consumption) of the environment, without focussing on the implementation of local biodiversity conservation policies in the development strategies, plans and policies and there is no local biodiversity information system to calculate a local biodiversity index in NL. This aspect of the research can be examined further in more details.

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Appendix 1 – UK Biodiversity Indicators

Indicator number, title, and measures where applicable			Status of indicator	Last updated[1]	Latest data[2]
A1. Awareness, understanding and support for conservation			Finalised	2015	2014
A2. Taking action for nature: volunteer time spent in conservation			Finalised	2015	2014
A3. Value of biodiversity integrated into decision making			Under development	2015	Not applicable
A4. Global biodiversity impacts of UK economic activity / sustainable consumption			Under development	2015	Not applicable
A5. Integration of biodiversity considerations into business activity	**A5a**. Environmental Management Systems		Finalised	2015	2013
	A5b. Environmental consideration in supply chains			2015	2013
B1. Agricultural and forest area under environmental management schemes	**B1a**. Area of land in agri-environment schemes	**B1a(i)**. Higher-level or targeted schemes	Finalised	2015	2014
		B1a(ii). Entry-level type schemes		2015	2014
	B1b. Area of forestry land certified as sustainably managed		Finalised	2015	2015
B2. Sustainable fisheries			Finalised	2015	2013
B3. Climate change adaptation			Under development	2015	Not applicable
B4. Pressure from climate change (Spring Index)			Interim measure available	2015	2015
B5. Pressure from **pollution**	**B5a**. Air pollution	**B5a(i)**. Area affected by acidity	Finalised	2015	2012
		B5a(ii). Area affected by nitrogen		2015	2012
	B5b. Marine pollution		Finalised	2015	2013
B6. Pressure from invasive species	**B6a**. Freshwater invasive species		Interim measure available	2015	2015
	B6b. Marine (coastal) invasive species			2015	2015
	B6c. Terrestrial invasive species			2015	2015
B7. Surface water status			Finalised	2015	2015
C1. Protected areas	**C1a**. Total extent of protected areas: on-land		Finalised	2015	2015
	C1b. Total extent of protected areas: at-sea			2015	2015
	C1c. Condition of Areas / Sites of Special Scientific Interest			2015	2015
C2. Habitat connectivity			Under development	2015	2007
	C3a. Status of UK habitats of European importance		Finalised	2013	2013

Indicator number, title, and measures where applicable			Status of indicator	Last updated[1]	Latest data[2]
C3. Status of European habitats and species	**C3b**. Status of UK species of European importance			2013	2013
C4. Status of UK priority species	**C4a**. Relative abundance		Finalised	2014	2012
	C4b. Distribution			2015	2012
C5. Birds of the wider countryside and at sea	**C5a**. Farmland birds		Finalised	2015	2014
	C5b. Woodland birds			2015	2014
	C5c. Wetland birds			2015	2014
	C5d. Seabirds			2015	2014
	C5e. Wintering waterbirds			2015	2013-14
C6. Insects of the wider countryside	**C6a**. Semi-natural habitat specialists		Finalised	2015	2014
	C6b. Species of the wider countryside			2015	2014
C7. Plants of the wider countryside			Under development	2015	2007
C8. Mammals of the wider countryside (bats)			Finalised	2015	2014
C9. Genetic resources for food and agriculture	**C9a**. Animal genetic resources – effective population size of Native Breeds at Risk	**C9a(i)**. Goat breeds	Finalised	2016	2015
		C9a(ii). Pig breeds		2016	2015
		C9a(iii). Horse breeds		2016	2015
		C9a(iv). Sheep breeds		2016	2015
		C9a(v). Cattle breeds		2016	2015
	C9b. Plant genetic resources – Enrichment Index		Finalised	2015	2015
D1. Biodiversity and ecosystem services	**D1a**. Fish size classes in the North Sea		Finalised	2015	2014
	D1b. Removal of greenhouse gases by UK forests		Finalised	2015	2013
	D1c. Status of pollinating insects		Finalised	2015	2010
E1. Biodiversity data for decision making	**E1a**. Cumulative number of records		Finalised	2015	2015
	E1b. Number of publicly accessible records at 1km^2 resolution or better			2015	2015
E2. Expenditure on UK and international biodiversity	**E2a**. Public sector expenditure on UK biodiversity		Finalised	2015	2014-15 financial year (public sector) and 2013-14 (NGOs)
	E2b. Non-governmental organisation expenditure on UK biodiversity			2015	
	E2c. UK expenditure on international biodiversity			2015	

[1] This is the year the indicator graph(s) or fiche was last changed (minor typographical changes will not be recorded).
[2] This is the latest year for which data for this indicator / measure are available.

Source: http://jncc.defra.gov.uk/page-4233

Appendix 2 Brief Timeline of Biodiversity Activities in the UK

2012	Proposed Terms of Reference for the Four Countries' Biodiversity Group produced (November 2012). 'UK Post-2010 Biodiversity Framework' published (17 July 2012). 'UK Biodiversity Indicators in Your Pocket 2012' (PDF, 1.25Mb) published (29 May 2012). Launch of BARS 2 (April 2012). Replacement of BRIG and UKBPSC with a revised Four Countries' Biodiversity Group.
2011	Letter sent to UK HAP and SAP group chairs and lead partners following a meeting of the UK BP Standing Committee (UKBPSC), confirming that the UK HAP and SAP groups are no longer accountable at a UK level (8 November 2011). Publication of England's biodiversity strategy - 'Biodiversity 2020: A strategy for England's wildlife and ecosystem services' (19 August 2011). Publication of England's Natural Environment White Paper – 'The Natural Choice' (7 June 2011). Launch of the UK National Ecosystem Assessment (UK NEA) (2 June 2011). 'UK Biodiversity Indicators in Your Pocket 2011' (PDF, 1.3Mb) published (20 May 2011). Publication of the new EU Biodiversity Strategy (3 May 2011). Scotland's first Land Use Strategy published (17 March 2011).
2010	CBD CoP 10 meeting held in Nagoya, Japan in October, resulting in The Strategic Plan for Biodiversity 2011–2020, and the creation of 20 targets for 2020 (the 'Aichi Biodiversity Targets'). Dissolution of the UK Habitat Groups, following a review of the groups involved with the UK BAP. 'UK Biodiversity Indicators in Your Pocket 2010' (PDF, 998kb) published. 2008 UK BAP Report published. UK Biodiversity Partnership Conference held in Stirling, Scotland. The UN International Year of Biodiversity.
2009	'UK Biodiversity Indicators in Your Pocket 2009' (PDF, 3.03Mb) published. CBD 4th National Report published. UK Biodiversity Partnership Conference held in York, England. Peak Ecology Report 'Mechanisms for filling knowledge gaps for Biodiversity Action Plan Species' (PDF, 469kb), with an underpinning spreadsheet (Workshop Appendix), published (January).
2008	Planning for implementation of conservation action for the UK List of Priority Species and Habitats. 2008 Reporting Round. Formation of the UK Habitat Groups, following the review of UK BAP and the publication of 'Conserving Biodiversity - the UK Approach'. 'UK Biodiversity Indicators in Your Pocket 2008' published (online-only version, available in The National Archives). UK Biodiversity Partnership Conference in Aberystwyth, Wales.
2007	Publication of the Species and Habitats Review Report (PDF, 1.3Mb). This report described the 1,150 priority species and 65 priority habitats identified during the review, and the processes used to identify them. The aim of the review was to ensure that the UK BAP list of priority species and habitats remained focussed on the correct priorities for action. This was the first full review of the UK BAP list, generated over 10 years earlier in 1995, and provided an opportunity to take into account emerging priorities, conservation successes and the large amount of new information that had been gathered since the original list was created. 'UK Biodiversity Indicators in Your Pocket 2007' published (PDF, 2.7Mb).

	UK Biodiversity Partnership Conference held in Aviemore, Scotland. Publication of 'Conserving Biodiversity – the UK Approach' (PDF, 439kb), a shared vision for UK biodiversity conservation, adopted by the devolved administrations. This document was published partly in response to the publication of the country strategies produced by the four countries of the UK (England, Northern Ireland, Scotland, Wales) following devolution. It set out the future shared priorities for UK conservation, and the responsibilities at UK- and country-levels.
2006	Publication of the Environment Strategy for Wales. Review of BRAG conducted. Review of priority species and habitats on-going. Publication of the revised species targets and habitats targets. Publication of the 2005 Reporting Round Results ('Highlights from the 2005 reporting round') (PDF, 753kb). UK Biodiversity Partnership Conference held in Belfast, Northern Ireland.
2005	Data gathering for the 2005 Reporting Round and the Targets and Species and Habitats Review work continues. CBD 3rd National Report published. UK Biodiversity Partnership Conference held in Bristol, England.
2004	Establishment of the BRIG working groups to undertake a review of the UK BAP, including: (1) plan the UK BAP 2005 reporting round; (2) review the priority species and habitat lists; and (3) review the action plan targets. Publication of the Scotland Biodiversity Strategy 'It's in your hands'. Publication of Plant Diversity Challenge – the UK's response to the Global Strategy for Plant Conservation. Launch of the first version of BARS (Biodiversity Action Reporting System). UK Biodiversity Partnership Conference held in Cardiff, Wales.
2003	Establishment of the UK Biodiversity Partnership, the UK Biodiversity Partnership Standing Committee (UKBPSC) and its two support groups – the Biodiversity Research Advisory Group (BRAG) and the Biodiversity Reporting and Information Group (BRIG). Publication of the 2002 Reporting Round Results ('Tracking progress – Highlights from the 2002 Reporting Round') (PDF, 491kb). First UK Biodiversity Partnership Conference held in Perth, Scotland.
2002	The 'Government response to the Millennium Biodiversity Report' (PDF, 111kb) proposed a new UK BAP structure comprising a UK Biodiversity Partnership, and a UK Biodiversity Partnership Standing Committee assisted by two advisory groups, the Biodiversity Reporting and Information Group and the Biodiversity Research Advisory Group.
2001	'Sustaining the variety of life: 5 years of the UK Biodiversity Action Plan' published after the first UK BAP reporting round in 1999, known as the 'Millennium Biodiversity Report'. In addition to reporting on progress, the MBR also made recommendations to government about changes to the UK BAP structure to reflect its progress and evolving responsibilities. CBD 2nd National Report published. Launch of the UK BAP website, to support the work of the secretariat and to publish relevant documents and information.
1996 - 1999	Tranche 2 Species and Habitat Action Plans published (6 volumes): 'Volume 1: Vertebrates and Vascular Plants' (PDF, 964kb), 'Volume 2: Terrestrial and Freshwater Habitats' (PDF, 718kb), 'Volume 3: Plants and Fungi' (PDF, 1.2Mb), 'Volume 4: Invertebrates' (PDF, 1.4Mb), 'Volume 5: Maritime Species & Habitats' (PDF, 2.4Mb), 'Volume 6: Terrestrial & Freshwater Species and Habitats' (PDF, 535kb).

1998	Devolution of Scotland, Wales and Northern Ireland. CBD 1st National Report published.
1996	Formal Government response to the UK Biodiversity Steering Group report published – 'Government Response to the UK Steering Group Report on Biodiversity' (PDF, 256kb) – and the UK Biodiversity Group established in place of the Steering Group, supported by individual country biodiversity groups (England, Scotland, Wales, Northern Ireland), and a National Targets Group, an Information Group, and a Local Issues Group.
1995	UK Biodiversity Steering Group published 'Biodiversity: the UK Steering Group Report Volume 1: Meeting the Rio Challenge' (PDF, 1.4Mb) and 'Volume 2: Action Plans (Tranche 1 Species and Habitat Action Plans)' (PDF, 1.2Mb). The Steering Group report established the framework and criteria for identifying the species (originally 1,250 in number) and the habitat types of conservation concern. Pilot projects were also undertaken to develop Local Biodiversity Action Plans (LBAPS).
1994	UK Government produced 'Biodiversity: the UK Action Plan' (PDF, 6.9Mb) and established the UK Biodiversity Steering Group to implement the UK BAP. The UK was the first country to produce a national biodiversity action plan. The UK BAP contained a list of 59 broad targets for the Government and its nature conservation agencies, in partnership with others, to conserve, and where practicable, to enhance wild species and wildlife habitats over the next 20 years. These targets were referred to as the '59 steps'.
1993	Convention on Biological Diversity adopted (29 December). It called for governments to enforce national strategies and action plans to conserve, protect and enhance biodiversity.
1992	Convention on Biological Diversity (CBD) (also referred to as the 'Rio Convention') signed by 159 governments, including the UK, at the Earth Summit in Rio de Janeiro. This was the first treaty to provide a legal framework for biodiversity conservation, and called for the creation and enforcement of national strategies and action plans to identify, conserve and protect existing biological diversity, and to enhance it wherever possible.

Source: JNCC (2015) - http://jncc.defra.gov.uk/page-5155, The UK Biodiversity Action Plan (UK BAP)

Appendix 3 – Canada's Biodiversity Policies and Priorities

Sub-Program 1.1.1: Biodiversity Policy and Priorities

Sub-program Description

This program enables Environment Canada to play a national leading role in engaging stakeholders, provincial and territorial governments, and other federal government departments in Canada's implementation of the United Nations Convention on Biological Diversity. The program provides scientific expertise, guidance and advice to decision-makers, and develops and applies models for social, cultural and economic valuation of ecosystem services to support sustainable development decision-making. This work enables information about the ecosystem and the environmental effects of development proposals to be factored into decisions across different levels of government, environmental and non-governmental organizations, the industrial sector, research community and the general public. Strategies used in Canada include the Canadian Biodiversity Strategy, Biodiversity Outcomes Framework, and Access and Benefit Sharing of Genetic Resources. Canada also participates internationally in the Convention on Biological Diversity; the Nagoya Protocol on Access and Benefit Sharing of Genetic Resources; the Nagoya-Kuala Lumpur Supplementary Protocol on Liability and Redress under the Cartagena Protocol on Biosafety; and Conservation of Arctic Flora and Fauna under the Arctic Council. The program also serves as the Canadian lead and national focal point for the UN-sponsored Intergovernmental Panel on Biodiversity and Ecosystem Services. Program funding includes Canada's annual contribution to the Secretariat of the Convention on Biological Diversity and support for international working groups.

Budgetary Financial Resources ($ Dollars)

2014–15 Planned Spending	2015–16 Planned Spending	2016–17 Planned Spending
2,454,400	2,443,342	2,443,342

Human Resources (FTEs)*

2014–15	2015–16	2016–17
14	13	13

*Totals may differ within and between tables due to rounding of figures.

Performance Measurement

Sub-Program 1.1.1: Biodiversity Policy and Priorities

Expected Result	Performance Indicator	Target	Date to be achieved
Biodiversity goals and targets are integrated into federal, provincial and territorial strategies and plans that have an impact on biodiversity	Percentage of federal departments with natural resource or environmental mandates, provinces and territories that have identified and are implementing measures to enhance biodiversity	100%	September 2014

Planning Highlights

In 2014–15, through the Biodiversity Policy and Priorities Sub-Program, the Department will:

- Prepare and coordinate Canada's participation in international meetings related to the Convention on Biological Diversity, the Nagoya Protocol on Access and Benefits Sharing of Genetic Resources, and the Conservation of Arctic Flora and Fauna (CAFF) Working Group of the Arctic Council. In addition, Environment Canada will host two meetings to advance implementation of the CAFFworkplan.
- Provide ongoing leadership and coordination to complete current priorities under the Canadian Biodiversity Strategy – including the national Biodiversity Goals and Targets, the Value of Nature to Canadians Study and the Canadian Nature Survey.
- In collaboration with federal, provincial and territorial partners, continue to develop and apply models for valuation of ecosystem services to support sustainable development decisions, and identify future priorities under the Canadian Biodiversity Strategy.

Source: Environment and Climate Change Canada (2017c), "2014–2015 Report on Plans and Priorities", Environment and Climate Change Canada, http://www.ec.gc.ca/default.asp?lang=En&n=024B8406-1&offset=4&toc=hide#s1.1.1