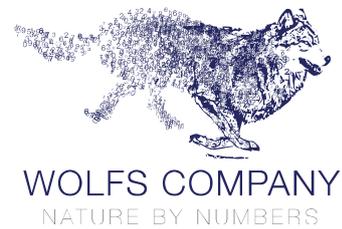

Report on workshops: Natural Capital Assessment in the South Atlantic



February 2017

Report on workshops: *Natural Capital Assessment in the South Atlantic*



 Funded by
UK Government

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Wolfs Company

Report on workshops:

***Natural Capital Assessment in the South
Atlantic***

Ascension: 17 & 18 February 2017

Falkland Islands: 21 & 22 February 2017

South Georgia: 23 February 2017

Wolfs Company

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Content

Introduction	6
Workshop Falkland Islands	8
<i>Schedule</i>	8
<i>Content day one</i>	10
Ecosystems, ecosystem services and stakeholders	10
Identifying threats and developing scenarios	12
<i>Content day two</i>	15
Values & externalities, valuation techniques and data collection	15
Results assignment 3	16
Afternoon session: Application of ecosystem service values, informing decision-making and assignment 4	18
Results assignment 4	19
<i>Evaluation of the Falkland Islands workshop by participants</i>	21
Ascension workshop	22
<i>Schedule</i>	22
<i>Content day one</i>	23
Introducing the concept of ecosystem services and potential scope and applications of a natural capital assessment on Ascension	23
<i>Content day two</i>	26
Lecture on values and valuation tools	26
Wrap-up discussion	26
Scoping session South Georgia & the South Sandwich Islands	28
Introduction	28
Ecosystems, ecosystem services and threats	29
Ecosystem services	30
Relevant threats to ecosystem services on SGSSI	32
Applying valuation results to policy processes	32
Recommendations for next steps	34
Appendix 1 - Participants	39
Appendix 2 - References	41
Appendix 3 - Slides	42
Appendix 4 – Data requirements and preliminary data gap analysis	43

Introduction

The South Atlantic Environmental Research Institute (SAERI) has been commissioned by the Joint Nature Conservation Committee (JNCC) to conduct a South Atlantic-wide assessment of natural capital. The aim of this project is to conduct a comprehensive valuation of natural capital of the British territories in the South Atlantic: Ascension, the Falkland Islands, South Georgia & the South Sandwich Islands, Saint Helena and Tristan da Cunha. The project is planned over the period of 2017 – 2019. The first part of the project aims to conduct pilot studies on the value of natural capital on the Falkland Islands, Ascension and South Georgia & the South Sandwich Islands.

As part of the project, SAERI commissioned Wolfs Company to develop inception workshops to introduce the concept of natural capital to stakeholders in the South Atlantic and develop the scope for the pilot studies. In February 2017, Wolfs Company led a two-day workshop on Ascension, a two-day workshop on the Falkland Islands, and a half day session about South Georgia & the South Sandwich Islands. The workshops built knowledge and shared experiences on the economic valuation of natural resources in the South Atlantic between different stakeholders involved in policy, science, nature management and representatives from the private sector. During the workshops, the scope for the natural capital assessment pilot study that will be conducted by SAERI was developed.

Furthermore, to stress the relevance of the natural capital pilot studies, the workshop aimed to raise awareness about the mutual interdependency of nature and the economy by introducing the concept of socioeconomic valuation of ecosystem services. Ecosystem services valuation provides a tool to mainstream nature management within social, environmental and economic sectors in the South Atlantic. Group assignments were developed to identify urgent environmental management problems that could be supported by the results of the natural capital assessment project.

Objectives of the workshops

The main objectives of the workshops were to increase understanding about why a study on natural capital is useful for the islands in the South Atlantic, and to develop the scope for natural capital assessments on Ascension, the Falkland Islands and South Georgia & the South Sandwich Islands.

The sub-objectives of the workshop were:

- To introduce the SAERI project on natural capital in the South Atlantic.
- To explain the concepts of natural capital and the socioeconomic valuation of ecosystem services.
- To provide training on the available methods and techniques for ecosystem valuation.
- To discuss the potential application of a natural capital assessment to relevant policy issues in the South Atlantic.
- To identify the relevant ecosystems, ecosystem services, environmental pressures and interventions and to prioritize these to support the scope for the natural capital assessment pilot studies.

The workshops combined theoretical sessions with interactive discussions and exercises. To identify how the natural capital research can be applied to important policy questions, working groups were assigned to develop future scenarios based on identified threats and potential management interventions on the Falkland Islands, Ascension and South Georgia & the South Sandwich Islands. At the end of each workshop, participants prioritized the most important policy interventions that could be supported by the natural capital assessment.

Structure

The set-up of the workshops was based on the framework presented in Figure 1 - "backbone" of economic analysis of ecosystem services. The framework reflects the research steps that should be part of a natural capital assessment. By combining theoretical presentations, examples from natural capital assessments elsewhere and practical sessions to apply the theory to the South Atlantic, participants were guided through the research process.

The workshops started by delimiting ecosystems and ecosystem services (step 1) in each of the islands and identifying relevant stakeholders in the context of these (step 2). By identifying threats to the selected ecosystems, scenarios were developed to assess the changes in ecosystem service benefits over time, and thereby assess the impact on different stakeholders (step 3). To quantify this socioeconomic impact, different types of values and available valuation techniques were discussed (steps 4-5). Based on selected valuation techniques, data requirements are established (step 6). Finally, it was discussed how the valuation results could support policy making processes and how these results could be communicated to relevant stakeholders and decision makers most effectively (steps 7-8).

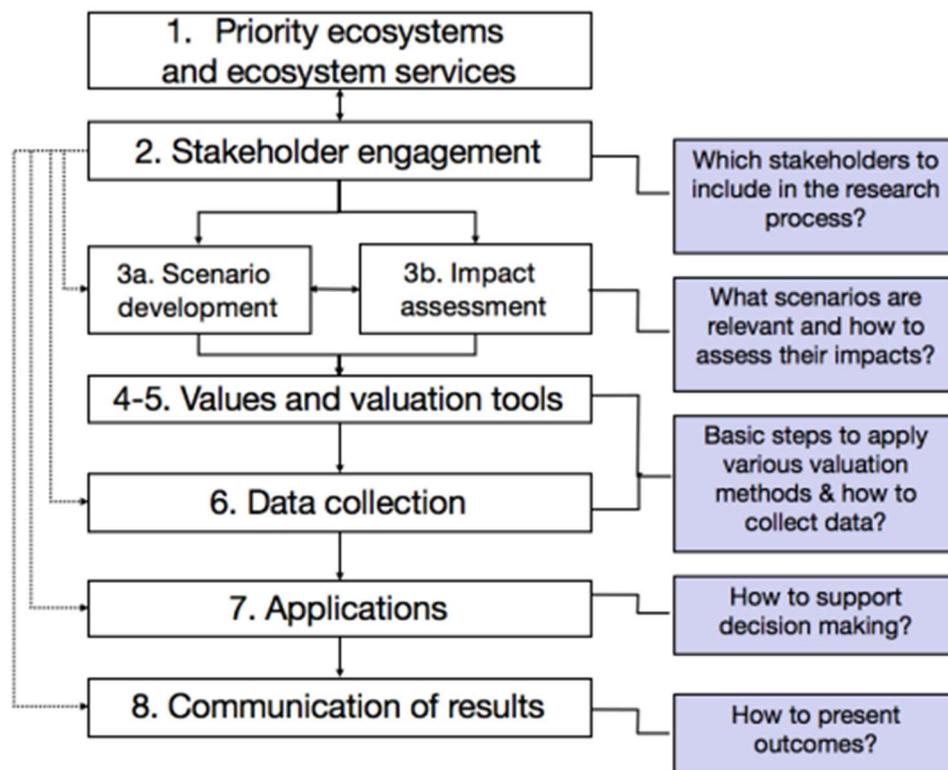


Figure 1 - "backbone" of economic analysis of ecosystem services

Workshop Falkland Islands



Figure 2 –participants in the workshop on the Falkland Islands. See appendix 1 one for an overview of the participants.

Schedule

Table 1 provides an overview of the contents of the workshop. Each section contains a short description. For the slides of the presentations please refer to appendix 3.

Table 1 - schedule of the workshop on the Falkland Islands.

Start	End	Tuesday, February 21
9.00	9.30	Introductions
9.30	10.30	1. Introduction TEEB Explanation of the role of environmental economics in decision-making processes. This session provides a framework to formulate the specific needs, challenges and environmental issues concerning an ecosystem services valuation study on the Falkland Islands. Screening of short documentary Natural Treasures of Bonaire to illustrate ecosystem services valuation on a small island.
10.30	10.45	<i>Coffee break</i>
10.45	11.30	2. Ecosystems, ecosystem services and stakeholders Identifying the most relevant ecosystems of the Falkland Islands. The Millennium Ecosystem Assessment and TEEB framework are introduced and used to identify ecosystem services and goods. Discussion on the role of stakeholders.
11.30	12.30	<u>Assignment</u> ¹ : Defining ecosystems, ecosystem services and stakeholders on the Falkland Islands.
12.30	14.00	<i>Lunch Break</i>

¹ In each assignment, the groups were subdivided into smaller groups. After the assignment, results of the different groups were presented and discussed with all the participants.

14.00	14.30	3. Threats and scenario development Explanation of the Daily framework and the required steps in a natural capital assessment. The framework builds the foundation of a scenario analysis to assess the effects of different management interventions.
14.30	15.30	<u>Assignment</u> : Develop scenarios for a natural capital study on the Falkland Islands. Identification of threats, management interventions and changes in ecosystems and ecosystem services.
15.30	15.45	<i>Break</i>
15.45	16.30	4. Values & externalities (postponed to next day) Grouping benefits from ecosystem services in different value categories. Discussion on how economic processes can impact the value of ecosystem services through the concept of externalities.
16.30	17.00	Plenary debrief & wrap-up
Start	End	Wednesday, February 22
9.00	9.30	Summary of previous day and structure of day 2
9.30	10.30	5. Valuation techniques Explanation of the different types of valuation techniques and methods.
10.30	10.45	<i>Coffee break</i>
10.45	11.15	6. Data collection Description of different types and discussion on data requirements and collection. Requirements of ecological, socioeconomic and spatial data and the use of primary vs secondary data are discussed.
11.15	12.30	<u>Assignment</u> : Valuation techniques Identify a selection of valuation techniques and methods to use for valuing identified ecosystem services based on the available data.
12.30	13.30	<i>Lunch Break</i>
13.30	14.30	7. Application of ecosystem services valuation Presentation on the application of natural capital research. The main applications that will be discussed are awareness raising, supporting development decisions, sustainable financing, damage assessment and spatial planning.
14.30	15.00	8. Influencing decision-makers Presentation of an approach on how to influence decision-makers with the results of an ecosystem service assessment.
15.00	15.15	<i>Break</i>
15.15	16.30	<u>Assignment</u> : Influencing decision-makers The final assignment will be used to develop the set up for local ecosystem valuation research. What do you want to achieve? Which policy questions need to be addressed in the research?
16.30	17.00	Plenary debrief & wrap-up

Content day one

Morning session and assignment 1: Ecosystems, ecosystem services and stakeholders on the Falkland Islands

The morning session started with an introduction of the participants and the trainers. Expectations of the workshop were discussed and it became clear that all participants approached ecosystem valuation studies as an instrument to achieve nature conservation goals. Box 1 presents a selection of the participant's expectations. Helen Baker from JNCC briefly presented the background and relevance of the natural capital assessment project in the South Atlantic, after which Tara Pelembe from SAERI briefly presented the overall project set-up.

Box 1 - Expectations of participants

"To get a better understanding of the Natural Capital concept"

"I would like to learn about how to incorporate this concept to industries on the Falklands"

"To hear more about how the theory can be applied to address the protection of water services"

"Discuss creative ideas for the NCAP"

"Learn more about innovations in natural capital assessments"

The Wolfs Company trainers continued by introducing the concept of The Economics of Ecosystems and Biodiversity (TEEB) and presented the different applications of ecosystem service valuation research by showing examples of successful application elsewhere. The ecosystem service framework of the Millennium Ecosystem Assessment (2005) identifies different categories of ecosystem services, see figure 2. After the introduction, the trainers elaborated on the concepts of ecosystems, ecosystem services and stakeholders that are important in an ecosystem services assessment. Furthermore, an approach was presented to identify stakeholders, and the relevance of stakeholder engagement throughout the process of economic analysis was discussed.

After the presentations and discussions, the participants were divided into four groups. Each group created an overview of the most important ecosystems and ecosystem services. The groups did not have to start from scratch. In 2012 and 2013, as part of a Darwin Initiative Challenge Award scoping project, researchers identified some key ecosystem services on the Falkland Islands (Tierney et al, 2014). Furthermore, in the *Falkland Islands Biodiversity Framework 2016 – 2030* that has been developed by the Falkland Islands Government, ecosystems (or ecoregions) on the Falklands are identified. Participants agreed that the classification of these ecoregions should be maintained in the natural capital study. It should be noted, however, that subcategories still need to be developed for the ecoregion "near shore coastal", as this category is too broad for valuation purposes.



Figure 1 – **top**: Groups work together to identify important ecosystems, ecosystem services and relevant stakeholders; **bottom**: presentation of the first assignment.

After identifying the relevant ecosystems and ecosystem services, participants discussed relevant stakeholders that need to be considered in the natural capital study. Stakeholders were grouped according to two scales: 1) how affected are they by changes in an ecosystem service; 2) how influential are they in the decision-making processes related to ecosystem services management. Due to time limitations, not all groups were able to complete the section about stakeholder involvement.

All groups presented their overview of ecosystems and ecosystem services. After the exercise, the participants prioritized the most important ecosystem services for the people on the Falkland Islands. The combined results of the different groups are summarized in Figure 3. The ecosystem services are presented in the order of relative importance (1, most important; 8 least important).

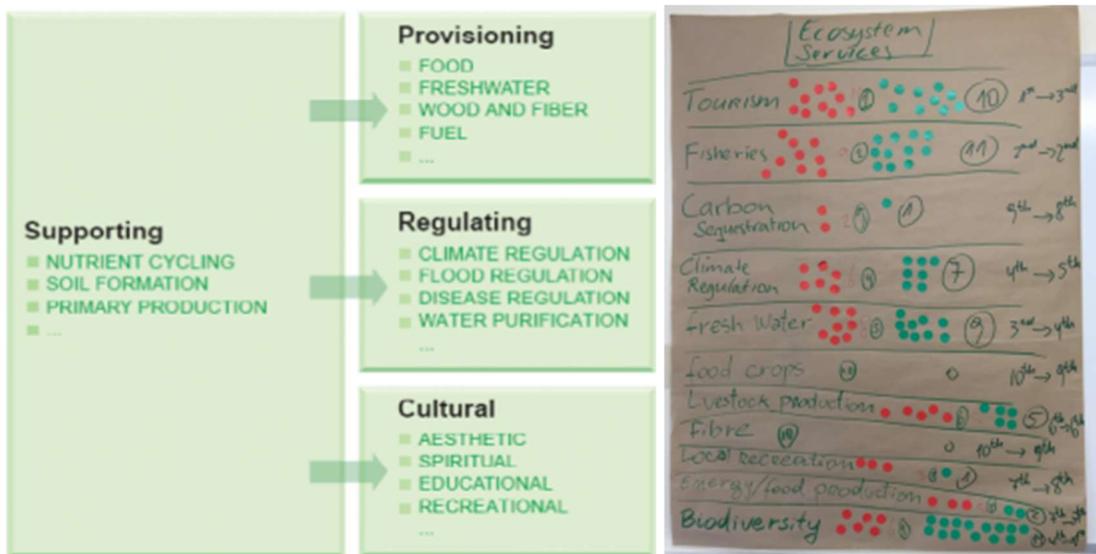


Figure 2 – **Left**: Categories of ecosystem services (source Millennium Ecosystem Assessment, 2005) **Right**: Prioritizing ecosystem services on the Falkland Islands (for the list of priority ecosystem services, please refer to Figure 3).



Figure 3 - identifying relevant ecosystems, ecosystem services and stakeholders on the Falkland Islands.

Afternoon session and assignment 2: Identifying threats and developing scenarios

In the afternoon, participants discussed the environmental threats to ecosystems on the Falkland Islands and how these threats will impact the services that ecosystems provide. To guide the development of future scenarios, the Daily Framework was introduced. In this framework, the impact of a threat or pressure to an ecosystem is translated into a change in the provision of an ecosystem service, and thereby into a change in the economic value of this service. The extent of these changes in economic benefits from ecosystem services determine the urgency to address threats by implementing policy interventions. This framework forms thus the basis for the development of scenarios. As an example, a scenario development and analysis of the Leuser rainforest ecosystem on Sumatra was presented.

Nick Rendell, from the Environmental Planning Department of the Falkland Islands government presented the threats that had been identified in the context of the *Falkland Islands Biodiversity Strategy 2016-2030* (see Table 2).

Table 2 - environmental threats identified by the Biodiversity Strategy 2016-2030

Global changes	<ul style="list-style-type: none"> • Climate change
High priority threats	<ul style="list-style-type: none"> • Invasive species and biosecurity
Medium priority threats	<ul style="list-style-type: none"> • Pollution • Disturbance by visitors / tourism • Overexploitation of natural resources: <ul style="list-style-type: none"> - Overfishing - Agriculture & livestock - Hydrocarbon resources
Low priority threats	<ul style="list-style-type: none"> • Natural disasters • Built development
Cross cutting challenges	<ul style="list-style-type: none"> • Lack of awareness (growing population, military) • Uncertainty, lack of information



Figure 4 – Nick Rendell presents the environmental threats that are described in the Falkland Islands Biodiversity Framework 2016 – 2030.

After the lecture, participants had to work on the second assignment. The participants were assigned to two groups and were given the task to develop future scenarios based on two drivers of change:

- Increased international demand for the industries on the Falkland Islands (livestock farming, fisheries and the hydrocarbon industry).
- Increased connectivity of the Falkland Islands, resulting in higher visitation rates.

Based on these drivers of change, the groups had to define the increase in environmental threats, the subsequent change in the state and quality of the ecosystems, the change in the ecosystem services and the subsequent economic impact. The groups proceeded to formulate potential policy interventions that could be implemented to reduce these environmental threats, build resilience of ecosystems and optimize the use of ecosystem services. Figure 5 provides the structure of the second assignment; Table 3 and Table 4 present the results per working group.

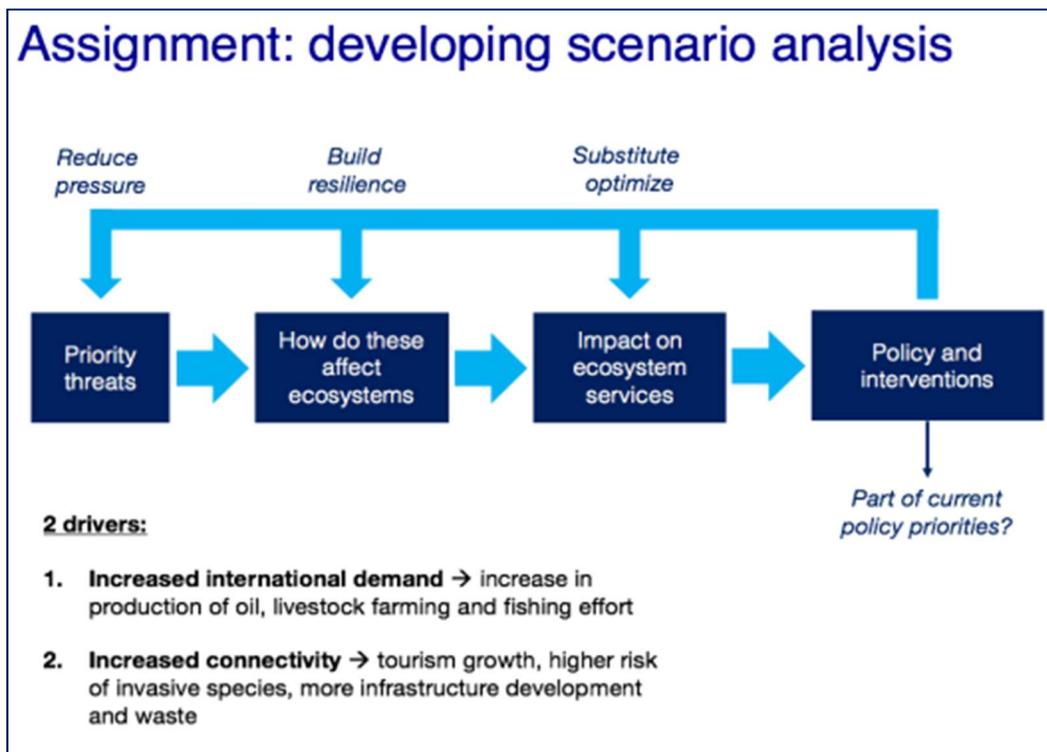


Figure 5 – structure for assignment 2: developing scenarios based on potential drivers for ecosystem services pressures on the Falkland Islands.

Table 3 - results of group 1: Increase in production by fishing industry, livestock farmers and the hydrocarbon industry, due to an increase in international demand.

Step 1 Threats	Step 2 Impact on ecosystem	Step 3 Impact on ecosystem service values	Step 4 Policy interventions
Increase fishing effort and aquaculture production → overfishing; pollution	All marine ecosystems ↓ Fresh water ecosystems ↓ Eutrophication ↓ Fish stocks ↓ Estuaries ↓ Bycatch ↑	Fisheries short-term ↑ Fisheries long-term ? <i>Attractive species for tourism</i> ↓ Fresh water provisioning ↓	<u>Currently in place:</u> Individual Transferable Quotas (ITQ) Total Allowable Catch limits (TAC) <u>Proposed interventions:</u> Ecosystem based management Marine Spatial Planning Drone Monitoring
Increase in livestock production → 1) increase in invasive species; 2) increased grazing and nutrient loading	Lowland ↓ Mountain ↓ Offshore Islands ↓ Coastal ecosystems ↓ Fresh water ecosystems ↓ Near shore marine ↓	Livestock production ↑ Fibre production ↑ Local recreation ↓ Tourism ↓	<u>Currently in place:</u> Biosecurity measures Biological control Research Eradication <u>Proposed interventions:</u> Biosecurity measures Legislation
Hydrocarbon production → 1) increase in pollution 2) Higher disaster risk	All ecosystems (except mountain ecosystems) would potentially face degradation ↓	Tourism ↓ Fisheries ↓ Fresh water provisioning ↓ Food production ↓ Climate regulation / Carbon sequestration ↓	<u>Currently in place:</u> Legislation Waste management Contingency plane <u>Proposed interventions:</u> Marine Spatial Planning Waste management Carbon offsetting

Table 4 – results of group 2: Increased connectivity of the Falkland Islands, resulting in higher visitation rates.

Step 1 Threats	Step 2 Impact on ecosystem	Step 3 Impact on ecosystem service values	Step 4 Policy interventions
Increased connectivity → 1) Increased disturbance 2) Increase in built development	Potentially all ecosystems would be affected by an increase in these threats. However, it should be noted that especially areas with high interest to tourists will be increasingly disturbed (e.g. Gypsy Cove, volunteer point etc.). Increases in built development are likely to affect areas near existing infrastructure.	Tourism ↑ Biodiversity ↓ Local recreation ↓ Fresh water provisioning ↓ Food production ↓	<u>Currently in place:</u> Tour guide accreditation (only volunteer point) Restricted areas (some places) Tourism quotas EIA <u>Proposed interventions:</u> Spatial planning (in progress) Strategic tourism planning
Increased connectivity → Higher risk of invasive species	Potentially all ecosystems would be affected by an increase in invasive species.	Tourism ↓ Biodiversity ↓ Local recreation ↓ Fisheries ↓ Livestock production ↓ Fresh water provisioning ↓	<u>Currently in place:</u> Ballast regulation (only policy, no legislation) Marine bill (draft) Customs control Waste restrictions <u>Proposed interventions:</u> Black and white lists (currently only ad hoc) Noxious weed regulation

After the presentation and discussions of the second assignment, the group decided to postpone the lecture on values and externalities to the next day. There was a short plenary debrief and wrap-up.

Content day two

Morning session: Values & externalities, valuation techniques and data collection

After day one, where the conceptual framework of economic analysis was extensively laid out, it was time to tackle the theory behind the actual valuation of ecosystem services. First, the values adding up to a total economic value were explained, ranging from direct-use values to non-use values. Thereafter, the trainers elaborated on the difference of financial versus economic value and the concept of externalities. The second lecture presented various valuation techniques. Depending on the ecosystem service value (e.g. use or non-use) and the available data, some techniques can be more applicable than others. See Table 5 for an overview of the valuation methods. The final lecture in the morning was about data collection. Possible sources for data and means of collection were discussed. The difference between primary and secondary data sources was emphasized.

Table 5 – summary of valuation techniques (U = Use value; NU = Non-use value)

Method	Value	Pro	Con
Market price	Use	Relatively easy	Ignores production factors
Production Function	Use	Actual behaviour	Only market goods
Travel Cost	Use	Accepted, recreation	Data, only recreation
Hedonic Pricing	Use	Actual behaviour	Data & analysis
Contingent Valuation	Use & Non-Use	Applicability U & NU	Hypothetical Data & analysis
Choice Experiment	Use & Non-Use	Applicability U & NU	Hypothetical Data & analysis

As part of the Darwin Challenge Award scoping project on environmental mainstreaming (Tierney et al. 2014), SAERI has developed a meta-data catalogue on environmental data available on the Falkland Islands. This catalogue will be a good starting point in the data collection process of the natural capital project on the Falklands. It has already been identified that the biggest data gap is the fact that there is no suitable habitat map available.

Results assignment 3 on values of ecosystems, valuation techniques and data sources

Based on the ecosystem services identified and prioritized during day one, participants set out to determine the specific values of ecosystem services, the valuation techniques they would apply and the data and data sources required to conduct the proposed analysis. The guidebook by Waite et al. (2014) was used for this exercise.

Table 6 presents the results of the assignment. Please note that the results have been structured by the trainers for reporting purposes. Also, small corrections were made to support the natural capital pilot study.

Table 6 – results of assignment: values, valuation techniques and data needs per ecosystem service.

Ecosystem service: TOURISM									
Values:	Direct use values (non-extractive)								
Valuation Techniques:	Production function, contingent valuation and/or travel cost method								
Data Types (availability unclear):	<table border="0"> <tr> <td>Tourism statistics</td> <td># of tours</td> </tr> <tr> <td>Tourist exit surveys</td> <td>Revenues per tour</td> </tr> <tr> <td>Tourist expenditures</td> <td>Costs structure of tourism industry</td> </tr> <tr> <td>Tourist activities / ecosystems used</td> <td></td> </tr> </table>	Tourism statistics	# of tours	Tourist exit surveys	Revenues per tour	Tourist expenditures	Costs structure of tourism industry	Tourist activities / ecosystems used	
Tourism statistics	# of tours								
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Tourist expenditures	Costs structure of tourism industry								
Tourist activities / ecosystems used									
Potential data sources:	<table border="0"> <tr> <td>Department of Tourism</td> <td>Tourism industry associations</td> </tr> <tr> <td>Tourist Exit Survey (maybe current TES provide sufficient information)</td> <td>Business survey</td> </tr> <tr> <td>Social media</td> <td></td> </tr> </table>	Department of Tourism	Tourism industry associations	Tourist Exit Survey (maybe current TES provide sufficient information)	Business survey	Social media			
Department of Tourism	Tourism industry associations								
Tourist Exit Survey (maybe current TES provide sufficient information)	Business survey								
Social media									
Ecosystem service: FISHERIES									
Values:	Direct use (extractive)								
Valuation Techniques:	Market Price and production function approach								
Data Types:	<table border="0"> <tr> <td><u>Available:</u> Fish prices Catch Stock Assessments Fishing effort and costs</td> <td><u>Unavailable:</u> Regional stock assessment Recruitment Ecological model</td> </tr> </table>	<u>Available:</u> Fish prices Catch Stock Assessments Fishing effort and costs	<u>Unavailable:</u> Regional stock assessment Recruitment Ecological model						
<u>Available:</u> Fish prices Catch Stock Assessments Fishing effort and costs	<u>Unavailable:</u> Regional stock assessment Recruitment Ecological model								
Data sources	FIFCA Fishermen Falkland Islands Government Scientific literature SAERI								
Ecosystem service: LIVESTOCK PRODUCTION, AGRICULTURE and ENERGY FROM PEAT									
Values:	Direct use values								
Valuation Techniques:	Market price and production function approach								

Data Types:	<u>Available:</u> Agricultural statistics (production meat, crops, wool, #livestock, etc.) Climate data	<u>Unavailable:</u> Habitat maps Grazing intensity Hydrological data watersheds Soil maps (under development by SAERI)
Data sources	FIMCO Wool companies Department of Agriculture Land owners	
Ecosystem services: ENERGY FROM PEAT and CARBON SEQUESTRATION		
Values:	Direct and indirect use values	
Valuation Techniques:	Market price and replacement cost methods	
Data Types:	<u>Available:</u> Energy values Resource estimates Costs and time Alternative fuels Carbon prices	<u>Unavailable</u> Soil maps (under construction SAERI) Carbon values
Data sources	Unknown	
Ecosystem service: FRESHWATER		
Values:	Direct use values	
Valuation Techniques:	Replacement costs	
Data Types:	<u>Available:</u> Water consumption Water availability	<u>Unavailable</u> Costs of alternative water sources (desalination plant, water purification) Hydrological data on watersheds
Data sources	Falkland Islands Government (directorate responsible for water) Engineering companies Statistics office Spatial planning department	
Ecosystem service: LOCAL RECREATION AND CULTURE		
Values:	Direct use and existence values	
Valuation Techniques:	Contingent valuation / choice modelling	
Data Types:	<u>Available:</u> Participatory mapping data	<u>Unavailable</u> Survey data on local recreation
Data sources:	Household survey among local residents	
Ecosystem service: BIODIVERSITY²		
Values:	Non-use: existence, option and bequest values	
Valuation Techniques:	Contingent valuation / choice modelling, benefit transfer	

² The ecosystem service Biodiversity was extensively discussed during the workshop. It was agreed that biodiversity is a supporting service to other ecosystem services that benefit human beings. On the other hand, it is also a value that human beings appreciate directly. To avoid double counting in an ecosystem services valuation, only the latter is considered.

Data Types:	<u>Available:</u> Existing literature	<u>Unavailable</u> Survey among residents in the UK
Data sources	UK residents Scientific journals	

Afternoon session: Application of ecosystem service values, informing decision-making and assignment 4

The afternoon session dealt with the application of ecosystem service valuation to support policy making. It was also discussed how optimize the impact of a natural capital study. First, various applications that deliver different insights were presented and discussed. In general, environmental economic research creates information and transparency by raising awareness of the value of nature for human wellbeing; by supporting decision-makers through scenario analysis, thereby creating insight in short and long term effects of policy decisions; by supporting spatial planning through the spatial visualization of ecosystem services; by identifying possible structures for sustainable financing for nature management; and by providing a tool to assess damage done to ecosystems. The objectives of the study and the policy question(s) at hand will guide the choice for a certain application, for example a cost-benefit analysis, or a spatial analysis in the form of a value map.

The final lecture was about the communication of the results of an ecosystem service valuation study. Different results were presented.³ By giving examples on how the applications appeal to different stakeholders, the participants were encouraged to develop ideas for a communication strategy for their conservation topics on the Falkland Islands.



³ For more information, visit: http://www.wolfscompany.com/?page_id=2036

Figure 7 – *upper left*: 5 types of applications of environmental economic research; *other pictures*: Discussing the potential application of natural capital research on the Falkland Islands.

Results assignment 4: identifying priority issues and applying ecosystem service valuation to address these

At the start of the exercise, individual participants were asked to list the four most urgent policy issues that could be supported by a natural capital study on the Falkland Islands. The number of mentions of a proposed policy issue was recorded, and the results are presented in Table 7 (from the most mentioned, to the least mentioned).

Table 7 – number of mentions of policy interventions that can be supported by a Natural Capital assessment as proposed by the individual workshop participants.

Priority policy issues	# mentioned
(Marine) spatial planning and integrated land-use management	7
Supporting nature conservation and biosecurity measures	7
Sustainable fisheries management	4
Supporting the Economic Development Strategy	3
Management of freshwater resources	3
Assessing climate change effects and climate change adaptation	3
Waste management	3
Collaborative management	2
Protecting aesthetic quality	1
Managing tourism pressure	1

After the selection of the most urgent policy issues, the participants were assigned to four different groups based on the top proposed policy issues: marine spatial planning and fisheries management⁴, strategic economic development, maintaining biosecurity, and conserving freshwater resources. For each of these policy issues, participants discussed:

- which decision-makers need to be convinced,
- what would be the message to these decision-makers,
- what potential application can be used to convey that message,
- how the results could be most effectively communicated to the relevant stakeholders.

Based on this exercise, the discussions that took place thereafter and the experiences shared by the trainers, the following applications for a natural capital study are proposed.

Supporting the spatial planning process on the Falkland Islands by developing value maps of ecosystem services

Most participants acknowledged that the natural capital study should contribute to the terrestrial and marine spatial planning processes on the Falkland Islands. Participants highlighted that a Marine Spatial Planning (MSP) process is currently being led by

⁴ During the workshop, these issues were addressed by the same group. In Table 7 these are presented as separate issues.

SAERI⁵. Terrestrially, public land is subject to spatial planning regulation. It was noted however, that privately-owned land is currently not part of the spatial planning process. Considering that the vast majority of land in the Falklands is privately owned, participants highlighted this as a potential risk. Although it was highlighted that there were currently no major problems related to undesirable land-use changes on private land.

By developing value maps⁶ of ecosystem services, the relative importance of different marine and terrestrial habitats for different stakeholders becomes visible. This information can be used to:

1. Identify and justify the designation of specific use categories in the spatial planning.
2. Assess whether current or proposed spatial planning regulation leads to spatial conflicts and assist in solving these.

Important stakeholders that need to be incorporated in such spatial planning process are the different users and owners of the marine and terrestrial areas (local residents, farmers, land owners, tour operators, fishermen and other businesses).

Supporting nature conservation and biosecurity measures through scenario analysis

During the exercise, it was mentioned that, although there are conservation efforts and biosecurity measures in place, there is a lack of support and understanding from the local population and especially visitors (i.e. tourists, seasonal workers, military personnel) towards these efforts and measures. Communicating the importance of nature conservation and the economic benefits related to it through a natural capital assessment, is considered an important step towards creating awareness.

Furthermore, by showcasing the economic benefits from investments in nature conservation efforts through scenario analysis, funds for nature conservation can be justified. This can support the nature conservation community on the Falkland Islands in the acquisition of funds from overseas (e.g. UK Government) and locally. Ecosystem service values could be analysed over time in scenarios that reflect at least: 1) high investments in nature conservation, and 2) low investments in nature conservation.

Contributing to the Economic Development Strategy (EDS)

During the workshop, it became clear that there is an opportunity to link the work within the natural capital assessment to support the Economic Development Strategy (EDS), which is due in April 2017. Although this time frame is too short to significantly contribute with insights to the document itself, there are two possible ways to timely contribute to the EDS:

1. To determine key ecosystem services that contribute to the economic development of the Falkland Islands and to formulate indicators for these ecosystem services in the EDS. The natural capital assessment can then contribute to the monitoring of the EDS by developing a baseline for these indicators.

⁵ For more information on the Marine Spatial Planning process, please visit: <http://south-atlantic-research.org/research/current-research/m-sp-ii>

⁶ For an example of the development of value maps to support spatial planning, please visit: <http://www.wolfscompany.com/wp-content/uploads/2014/07/R14-13-Value-mapping-of-nature-on-St-Eustatius.pdf>

2. Assessing the effects of proposed policy in the EDS by conducting scenario analysis. By estimating the effects of the EDS strategy on ecosystem service values in the future, it becomes clear whether the desired socioeconomic effects will be achieved.

Furthermore, it can be concluded from the workshop that fisheries, tourism and livestock farming are the most important ecosystem services that contribute to economic development. Assessment of these sectors in the natural capital study will produce useful information for strategic economic planning.

Managing freshwater resources

On the Falkland Islands, water is provided by inland freshwater reservoirs. Many of these freshwater reservoirs can be found on privately-owned land and are affected by land-use. The great importance of these reservoirs and the high replacement costs if these would be polluted and disappear was presented by one of the groups. It was also highlighted that awareness among local residents, policy makers and visitors (tourists, military personnel and seasonal workers) must be raised to secure the water supply of the Falkland Islands.

It was then proposed to conduct a cost-benefit analysis (CBA) of different investments to secure the future water supply. Scenarios that can be compared in the CBA include: investing in a desalination plant, investing in water purification facilities and investing in the conservation of existing freshwater reservoirs.

Evaluation of the Falkland Islands workshop by participants

Although the workshop was running late on the second day due to the lively discussion among the participants regarding the application of the natural capital assessment to policy processes on the Falkland Islands, some participants still took the time to fill in an evaluation form.

In general, the workshop met the expectations of the participants and all respondents would recommend the workshop to others. Some respondents mentioned that they would have preferred to have more time to complete the group assignments. Participants and respondents to the evaluation form mentioned that the “case studies made very good examples to clarify the use of natural capital. All respondents stated that they intend to apply the natural capital concept in their work.

Ascension workshop



Figure 4 – participants in the Ascension workshop. For a complete overview of the participants, please refer to Appendix 1.

Schedule

Due to a 24-hour delay in the MoD air bridge flight from Brize Norton to Ascension, the content of the two-day workshop was substantially compressed into two half-day sessions. This resulted in some crucial lectures and assignments being left out of the schedule. Furthermore, one of these sessions was scheduled for Saturday morning and was attended only by a small number of participants.

Unfortunately, this limited the discussion, and thereby the reporting, on the potential scope for a natural capital assessment on Ascension and the potential applications thereof.

Table 8 provides an overview of the content of the workshop on Ascension. Each section contains a short description. For the slides of the presentations please refer to appendix 3.

Table 8 – schedule of the workshop on Ascension

Start	End	Friday, February 17
13.00	13.15	Introduction workshop participants Short round of introductions by the workshop participants and the trainers
13.15	13.30	Background and overview of the project Dr Helen Baker (JNCC) and Tara Pelembe (SAERI)
13.30	14.15	1. Introduction to ecosystem service valuation We will explain the role of environmental economics in decision-making processes. This session provides a framework to formulate the specific needs, challenges and environmental issues concerning an ecosystem services valuation study on Ascension. The short documentary <i>Natural Treasures of Bonaire</i> is presented to illustrate ecosystem services valuation on a small island.
14.15	15.15	A guided discussion on the scope for an ecosystem services assessment on Ascension. Relevant ecosystems, ecosystem services and stakeholders on are identified.
15.15	15.30	<i>Break</i>

15.30	16.30	Group exercise Develop scenarios for a natural capital study on Ascension. Identification of threats, management interventions and changes in ecosystems and ecosystem services.
16.30	17.30	Wrap-up and plenary discussion on the application of a Natural capital study on Ascension.
Start	End	Saturday, February 18
10.00	10.45	4. Values & externalities In this session, benefits from ecosystem services are grouped in different value categories. We discuss how economic processes can impact the value of ecosystem services through the concept of externalities.
10.45	11.30	5. Valuation techniques We will present and explain the different types of valuation techniques and methods.
11.30	12.30	Wrap-up

Content day one

Afternoon session and group assignment: introducing the concept of ecosystem services and potential scope and applications of a natural capital assessment on Ascension

After general introductions by the workshop participants and the trainers, Helen Baker from JNCC briefly presented the background and relevance of the natural capital assessment project in the South Atlantic, after which Tara Pelembe from SAERI briefly presented the overall project set-up.

After the introduction of the project, the Wolfs Company trainers introduced the concept of The Economics of Ecosystems and Biodiversity (TEEB) and natural capital, and presented the different applications of ecosystem service valuation research by showing examples of successful application elsewhere. It was discussed how different applications of natural capital assessment can support decision-making processes by informing key decision-makers.

After the introductory session, the trainers elaborated on the concepts of ecosystems, ecosystem services and environmental threats. A plenary discussion followed in which the relevant ecosystems, services and threats on Ascension were identified. The ecosystem services were grouped according to the ecosystem service framework of the Millennium Ecosystem Assessment (2005), into three different categories (provisioning, regulating and cultural ecosystem services). To avoid double counting in an ecosystem services valuation, supporting ecosystem services were not included in the discussion. The results of the discussion are presented in Table 9 and Table 10.

Table 9 – ecosystems on Ascension as identified by workshop participants. It was highlighted by the workshop participants that a comprehensive habitat map is being developed by the nature conservation department of the Ascension Island government.

Step 1 Environmental threats	Step 2 Ecosystems affected	Step 3 Change in ecosystem services	Step 4 Policy interventions
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department of the Ascension Island government.

Shallow marine habitats	<ul style="list-style-type: none"> • Rocky reef habitats • Rhodolith beds • Sandy habitats
Pelagic marine habitats	<ul style="list-style-type: none"> • Pelagic zone • Sea mounts
Coastal habitats	<ul style="list-style-type: none"> • Beaches • Rocky coastline • Pools
Terrestrial habitats	<ul style="list-style-type: none"> • Lava flows and ash fields • Lower altitude peaks • Man-made cloud forest (green mountain)

Table 10 – Ecosystem services on Ascension as identified by the workshop participants.

Provisioning services	<ul style="list-style-type: none"> • Fishing • Water • Rock • Aggregate for construction • Vegetable production / hydroponics
Regulating services	<ul style="list-style-type: none"> • Microclimate control • Carbon sequestration • Regulation of water flows
Cultural services	<ul style="list-style-type: none"> • Local recreation (diving, snorkeling, hiking, fishing) • Tourism (including the potential for tourism) • Potential for research

After the group discussion and a short break, the workshop participants were assigned to three groups. The groups were given a selection of the ecosystems that were previously identified: group 1, shallow and pelagic marine habitats; group 2, coastal habitats; and group 3, terrestrial habitats.

Each group was then asked to identify environmental threats to the assigned ecosystem. Based on these threats, changes to the given ecosystem and impacts on the value of ecosystem services were to be described. The participants were then asked to think about potential interventions to manage these threats, build resilience of ecosystems or optimize ecosystem services provision. Table 11 presents the results of the group exercise.

Table 11 - results of the group exercise on Ascension. For a visual representation of the assignment, please refer to Figure 5.

Group 1	<ul style="list-style-type: none"> • Shipping/ pollution by boats • Invasive species • Overfishing • Climate change • Poor waste management 	<ul style="list-style-type: none"> • Shallow marine habitats • Pelagic zone • Seamounts 	<ul style="list-style-type: none"> • Diving ↓ • Fishing ↓ • Carbon sequestration ↓ • Water provisioning ↓ • Spiritual / aesthetic values ↓ 	<ul style="list-style-type: none"> • Ballast water regulation • Ship hull cleaning • Responsible fishing practices • Renewable alternatives • Waste management strategy • Spatial planning • Research and monitoring
Group 2	<ul style="list-style-type: none"> • Sand mining • Coastal development • Climate change effects (wind patterns, sea level rise, temperature) • Pollution (oil spill, litter) • Invasive species • Human disturbance 	<ul style="list-style-type: none"> • Beaches • Pools • Rocky coastline 	<ul style="list-style-type: none"> • Turtle tours ↓ • Recreational activities (beach, hiking) ↓ • Biodiversity ↓ • Research ↓ 	<ul style="list-style-type: none"> • Prohibit sand mining • Reduce coastal development (e.g. football pitch) • Raise public awareness through education • Implement a waste management strategy • Remove invasive species • Enforcing the WPO
Group 3	<ul style="list-style-type: none"> • Infrastructure development • Erosion • Reckless human activity • Aging canopy • Climate change • Pests • Pollution 	<ul style="list-style-type: none"> • Cloud forest • Semi-arid lava flow and low altitude peaks 	<ul style="list-style-type: none"> • Recreational activities (hiking) ↓ • Erosion control ↓ • Fruit production (allotments) ↓ • Human health ↓ • Decrease in biodiversity 	<ul style="list-style-type: none"> • National park planning • Spatial planning • Awareness raising through education • Enforcing regulation • Supporting ecotourism



Figure 5 – participants in the Ascension workshop work on the group exercise.

Content day two

Lecture on values and valuation tools

An additional morning session was organized on Saturday morning to compensate for the 1,5 days of the workshop lost due to flight disturbances. Participants that were interested in learning more about the values that can be derived from ecosystem services and appropriate valuation techniques could sign up for this optional session. As it was organized on Saturday morning, only few participants could attend. Despite the small number of participants, the increased understanding of the ecosystem services values contributed to an in-depth discussion on the potential application of the Natural Capital project on Ascension. For an overview of the valuation techniques that were discussed, please refer to Table 5 in the chapter on the results of the Falkland Islands workshop.

Wrap-up discussion

Despite the lost time, the workshop assignment was still successful to determine the potential scope of ecosystems and ecosystem services for the natural capital assessment. During the discussion of the assignment, however, participants found it hard to identify the most serious environmental threats and the most urgent policy interventions that follow from these. In order to explore the possibilities for the application of the natural capital assessment to local policy, this discussion was continued Saturday morning after the lectures.

Based on the discussions over the two days, it was concluded that a natural capital study on Ascension could contribute to the following policy processes.

- **Spatial planning** – According to the participants, a structured spatial planning process is lacking on Ascension. Cooperation between the Ascension Government and US and UK military on the matter are not always without discussion. Development decisions are taken on an ad-hoc basis, without proper consultation of

all relevant stakeholders on Ascension. A marine and terrestrial spatial plan could significantly improve efficient allocation of land- and seascapes. By assessing and mapping the relevant ecosystem services on Ascension, on the use of the public space and natural areas by different stakeholders will be researched. This will help to identify spatial conflict and facilitate an efficient spatial planning process.

- **Strategic economic planning** – Participants highlighted that there is no documented vision for the future development of Ascension. There is no strategic plan. The natural capital assessment could contribute to the identification of potential for economic development related to the ecosystem services on the island. It was highlighted, for example, that Ascension is home to a wealth of tourist attractions that might be capitalized on if tourism development would be stimulated. There is currently very little tourism due to an almost non-existent private sector on Ascension.
- **Waste management and sewage** – Waste management was highlighted as an important problem on Ascension. The landfill on Ascension, for example, has a negative effect on the fragile terrestrial and marine ecosystems on Ascension, thereby threatening the ecosystem services provided. Although efforts are being undertaken to improve waste management, the participants stressed that the natural capital study might contribute to raising awareness on the effects of poor waste management. To do so, a cost-benefit analysis of waste management investments could be developed in which the effects of poor waste management on the value of natural capital are incorporated. This will also support the Ascension Island Government in determining whether investments in waste management are efficient policy measures.
- **Impact assessment of infrastructure development** – It was mentioned that a natural capital study could support a socioeconomic impact assessments of infrastructure development on Ascension. Specifically, such the study could support the development of the plans for maintenance of the airport between 2018-2019 that are currently under development. By assessing the impact of the airport maintenance activities on the value of natural capital on Ascension, a plan can be developed that benefits all stakeholders on the island. A cost-benefit analysis of various alternatives that incorporates effects on ecosystem services could be conducted to support the decision-making process around the development of airport maintenance plans.

Scoping session South Georgia & the South Sandwich Islands



Figure 6 – participants in the scoping session on South Georgia & the South Sandwich Islands. FLTR: Anne Saunders (JNCC), Paul Brewin (Government of South Georgia and the South Sandwich Islands), Stijn Schep (Wolfs Company), Tara Pelembe (SAERI), Amilcar Guzman (Wolfs Company) and Helen Baker (JNCC).

Introduction

After the workshop on the Falkland Islands, an inception meeting for the natural capital assessment on South Georgia was organized between representatives from The Government of South Georgia & the South Sandwich Islands (SGSSI), JNCC, SAERI and Wolfs Company. As Paul Brewin (Government of SGSSI) already participated in the workshop on the Falkland Islands, there was no need to provide a theoretical introduction to the project. This allowed for a semi-structured meeting in which ideas for the natural capital study could be discussed.

The goal of this brief session was to:

1. Develop a scope for the natural capital assessment to be conducted by SAERI.
2. Discuss how the study on natural capital could support policy processes relevant to SGSSI.

This section describes the findings of the scoping session. This section starts with a short description of ecosystems, ecosystem services and threats that are relevant on SGSSI. Finally, the potential application of the project to relevant policy processes is discussed. Furthermore, potential data sources for the natural capital assessment were discussed.

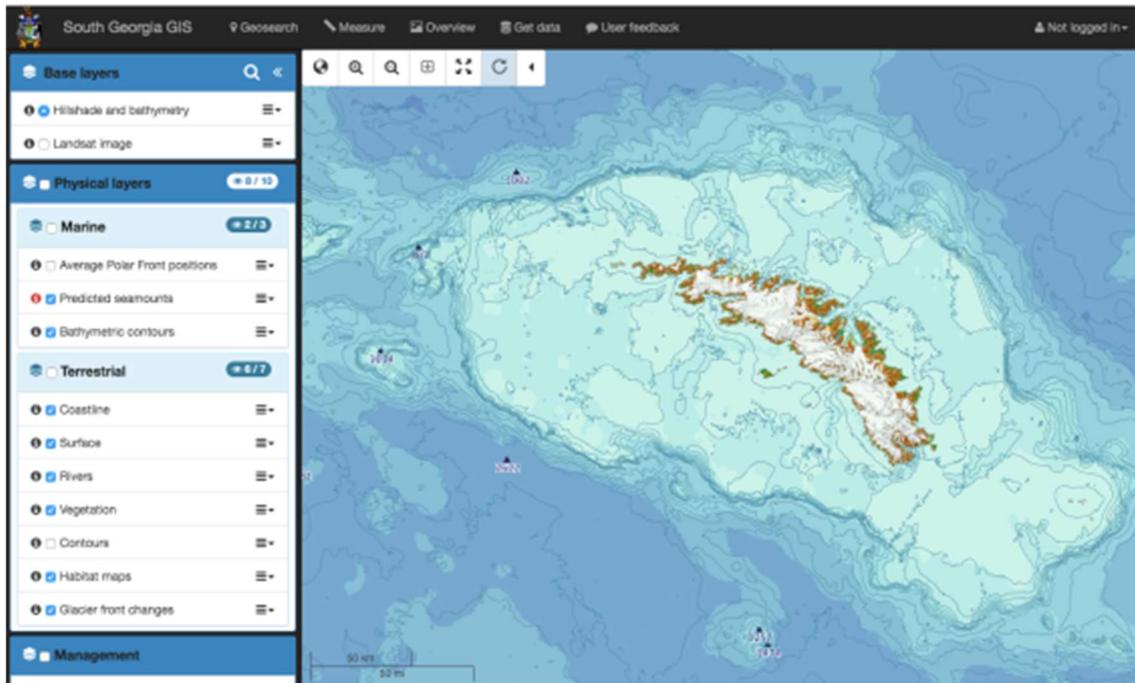


Figure 7 – Screenshot of the GIS database of the SGSSI Government (link: <http://www.sggis.gov.gs/>).

Ecosystems, ecosystem services and threats

Ecosystems

The meeting started with a discussion on the terrestrial ecosystems on SGSSI and the marine ecosystems within the exclusive economic zone. It was mentioned that available data on ecosystems can be found through the government website. The website features a GIS database (link: <http://www.sggis.gov.gs/>), in which spatial data on ecosystems are available.

From these data, it becomes clear that there is information on:

Terrestrial ecosystems

- Surface water (rivers and lakes)
- Rock areas
- Moraines
- Ice cover
- Vegetation cover (full, partial and sparse)
- Habitat maps (a few areas have been mapped more extensively to provide an idea about the vegetation types)
- Distribution of species (penguins, albatross, pipit, seals, petrels).
- Built-up land

Marine ecosystems

- Data on bathymetry
- Expected location of sea mounts
- Results of various dive surveys in the shallow coastal area

It has to be noted that the GIS database is currently being updated and refreshed in the light of a Darwin+ project. As part of the update new data on fisheries, various land-use layers, and MPA related research will be added to the database.

The SGSSI Government aims to support their Marine Spatial Planning process with the best scientific information available. However, it is indicated that insufficient information is available about the marine area in the waters around SGSSI to understand the importance of marine areas for the provisioning of ecosystem services. Of the marine habitats, especially the sea mounts located in the waters around SGSSI are understudied. It is expected that the sea mounts play an important role in the production of toothfish stocks. However, due to the high costs involved, a comprehensive assessment of these marine habitats has never been conducted. Furthermore, the shallower marine habitats that surround the islands are not currently mapped sufficiently to support an ecosystem services mapping exercise.

Ecosystem services

Although there are no permanent residents on SGSSI, it is estimated that about 15,000 people actively use the natural environment of the SGSSI every year. From this figure, 10,000 are tourists and 5,000 are either fishermen or researchers. In the meeting, the following ecosystem services were discussed: tourism, fishing, conducting scientific research, carbon sequestration and the existence value of biodiversity and iconic species. These ecosystem services can be classified in the following three categories: provisioning, regulation and cultural services.

Provisioning services

Fishing:

SGSSI is home to commercial toothfish, krill and icefish fisheries. The economically most important fishery, the toothfish fishery, is currently certified under the Marine Stewardship Council (MSC). The government of SGSSI manages the fisheries and awards six toothfish licences, seven krill fishery licences and one icefish licence on an annual basis.

It was discussed that research on the spawning grounds of the toothfish stocks around SGSSI exists, but that the information is insufficient to provide a complete picture about the role of different marine habitats in supporting the toothfish fisheries.

Data on fish catch and fishing areas is already being collected by the Government of SGSSI for a long time, so an economic valuation can be based on an elaborate time series of catch numbers and revenue. Fishing companies could be approached to retrieve information about the costs of fishing to support the economic valuation of the toothfish fisheries.

Regulating services

Carbon sequestration

Both terrestrial vegetation and marine habitats contribute to carbon sequestration. However, the lack of information regarding marine habitats limits the economic valuation of carbon sequestration.

Regarding terrestrial habitats it is unclear, at this point, whether the available information is sufficient to conduct an economic valuation of this ecosystem service.

Cultural services

Tourism:

Most of the 10,000 tourists visit South Georgia by cruise ship, while some visit the islands by yacht. Most of the cruise ships use South Georgia as an intermediate stop on their way to the Antarctic Peninsula. The main attractions for these cruise and yacht tourists are the natural environment (i.e. the beautiful landscape and the iconic animal species) and the cultural heritage (historically, the islands were mainly inhabited by whalers; old whaling stations can still be found on the island of South Georgia). The South Sandwich Islands are not currently visited by tourists in large numbers. The natural capital study could investigate the potential for the development of sustainable tourism in this area.

Information and data: most of the cruise lines that visit SGSSI are member of the International Association of Antarctica Tour Operators, with which the islands' government has a good working relationship. The cruise lines collect a lot of tourism statistics that could potentially be used for the natural capital assessment. Furthermore, many tourism surveys have been conducted to assess which of SGSSI's features appeal most to visitors. It is unclear whether the latter provide sufficient information to assess for an economic valuation of the ecosystem services related to tourism. Conducting a survey among tourists is likely to be required for the estimation of the value of nature for tourism in the context of this natural capital assessment.

Research

Many researchers from around the world visit South Georgia to investigate a wide range of topics related to our natural environment. From ecological research on the species that can be found on the islands itself to global issues like climate change.

All research is either fully coordinated and funded by the Government of SGSSI, coordinated via its partners who are externally funded, or in the least coordinated through a science permitting process. BAS can be considered the primary provider of scientific research on the terrestrial and marine environments, but the Government of SGSSI engages with a wide range of specialists and contractors.

Information regarding the costs of doing research, the research topics and the number of researchers would be required to include this ecosystem service in the natural capital study. The Government of the SGSSI indicated that this information is documented and can be made available to support the study.

Existence value of biodiversity and iconic species

SGSSI have highly biodiverse ecosystems that provide habitat to a wide variety of iconic species. This high biodiversity is likely to be valued by many people all over the world that do not intend to visit the islands for its existence. Especially for the South Sandwich Islands this is expected to be the most important economic value.

To put an economic value on this "existence value", a survey can be developed among residents in the United Kingdom to determine the willingness-to-pay for the conservation

of nature on the SGSSI. Also, an assessment could be made of the conservation efforts by conservation NGOs that are active in the study area.

Relevant threats to ecosystem services on SGSSI

During the meeting, various environmental threats were discussed that potentially compromise the value of ecosystem services on SGSSI. These included:

- Invasive species in the terrestrial and marine environments. The Government of SGSSI spends many resources on the eradication of invasive species, such as reindeer and rats. Due to the isolated nature of the islands, the risk of environmental degradation because of invasive species is large.
- Disturbance by visitors. Increasing interest and numbers of visitors lead to increasing pressure on ecosystems.
- Illegal fishing, which is difficult to enforce with due to the large area to be covered. The Government of SGSSI funds its own fisheries compliance and protection regime and is supported by the military surveillance efforts. Through these tools, GSGSSI are able to effectively protect against illegal fishing. However, support would be needed to utilise new technologies in surveillance which are expensive and require more widely coordinated effort (e.g. Satellite monitoring, drones, etc.).
- Climate change will have a great impact on the landscape of SGSSI. A large area is currently covered by permanent ice, which is decreasing due to an increasing temperature.
- Unforeseen negative impacts on toothfish stocks. As fisheries are the main contributor to the economy of SGSSI and the government budget (approximately 75% comes from the fishing permits), a collapse of the fish stocks would lead to severe financial problems for the territory. These impacts can be driven by climate change, overfishing, pollution and other factors that might be beyond the control of the SGSSI Government.

Applying valuation results to policy processes

The threats described above give rise to the following applications of the natural capital assessment on SGSSI.

Effects of climate change on ecosystem services

Due to an increasing global temperature, glaciers on SGSSI are retreating. This process changes the landscape and habitats dramatically. In areas that were covered with permanent ice, suddenly new habitats are developing. While this enables increased access by visitors and provides interesting opportunities for researchers, the negative effects of this trend on existing ecosystems and species is not elaborately studied. The fear exists, for example, that this trend will also lead to a higher risk of invasive species. It was discussed that the natural capital project can contribute to a better understanding of the socioeconomic effects of retreating glaciers.

Climate change potentially also impacts the fisheries of SGSSI and thereby the main economic activity on SGSSI. The natural capital study can help to support the Government of SGSSI by exploring the effects of climate change on the value of the fisheries. This information can be used to develop policy that increases the resilience of the fisheries to climate change.

Supporting spatial planning (marine and terrestrial)

The Government of SGSSI applies an evidence based approach to spatial planning in its territorial waters, the exclusive economic zone and the terrestrial environment. Increased understanding of the different uses of natural capital and the spatial distribution of this use, will support this process. In terms of the terrestrial and coastal environments, mapping the areas of interest to tourists and researchers could support more efficient spatial planning.

The timing of the natural capital project aligns well with the development of the plan for Marine Protected Areas (MPA). In 2018, a draft report will be presented to a review committee with representatives from the fishing industry, tourism industry, NGOs and the Government of SGSSI. It was agreed that the natural capital project can be valuable to this process.

CBA of conservation efforts

As the extend of the natural areas that are managed by the Government of SGSSI is large and the budget is limited, trade-offs are constantly made between different conservation priorities. The *Biodiversity Action Plan for SGSSI 2016-2020* provides an overview of the currently identified conservation priorities.

During the meeting, it was discussed that the natural capital project could contribute to the decision-making process by conducting a cost-benefit analysis (CBA) of various conservation investments. By comparing the financial costs of conservation with the benefits in terms of ecosystem services, insight is created in the economic viability of conservation efforts. It was highlighted that a knowledge gap exists with regards to the benefits generated by the ecosystems of the South Sandwich Islands. The information that would be generated supports the Government of SGSSI to allocate its resources most efficiently.

Recommendations for next steps of the natural capital assessment in the South Atlantic

SAERI is in the process of recruiting a project manager that will be exclusively assigned to the natural capital project in the South Atlantic. The project manager, who will be trained in environmental economics, will coordinate the three pilot projects on Ascension, the Falkland Islands, and South Georgia & the South Sandwich Islands. The pilot projects are expected to be finalized in 2018, after which the natural capital assessment will expand to the other islands in the South Atlantic.

The outcome of the workshops gives an indication of the scope and design of three natural capital pilot studies. Furthermore, it was discussed which tools could be used to conduct such an analysis. In this section, the next steps are described for the successful implementation of the three pilot studies. First of all, it is described how the scope for the studies can be finalized. Based on the selection of ecosystem services, the next step is to define the methodology for valuation and to formulate the data requirements. Finally, the potential applications of the valuation results are described to support governance processes on the three territories.

Step I: Finalizing scope for pilot projects

The first step is to finalize scope of the three pilot projects and discuss this scope with key stakeholders. Based on the outcome of the workshops, a longlist of relevant ecosystems, ecosystem services and stakeholders can be identified. Table 12 provides an overview of the ecosystems that were identified during the workshops. Based on the analysis of the available data on marine and terrestrial habitats, the definition of these ecosystems may be adapted to align with existing definitions.

Table 13 provides an overview of the relevant ecosystem services that were identified during the workshops.

The following questions may guide the process of narrowing down the scope:

1. What is the main objective the natural capital study? The objective should reflect the issue you would like to address and how the study can inform potential solutions or ways to deal with this issue.
2. What are the research questions you would need to answer to achieve your objective?
3. Who are the main stakeholders you need to involve in your natural capital study? And how? Keep in mind their degree of influence and interest to define the type of involvement you would like to promote.
4. What are the key ecosystem services you need to assess to answer your research questions?

Table 12 – proposed scope of ecosystems for the three territories. Please note that ecosystems have not been defined for SGSSI.

	Falkland Islands	Ascension	SGSSI
Marine	<ul style="list-style-type: none"> • Deep sea • Pelagic shelf • Near shore coastal (to be further defined) 	<ul style="list-style-type: none"> • Rocky reef habitats • Rhodolith beds • Sandy habitats • Pelagic zone • Sea mounts 	To be defined
Coastal	<ul style="list-style-type: none"> • Estuarine • Small offshore islands 	<ul style="list-style-type: none"> • Beaches • Rocky coastline • Pools 	To be defined
Terrestrial	<ul style="list-style-type: none"> • Fresh water - riverine • Fresh water - ponds and lakes • Lowlands • Montane • Built environment 	<ul style="list-style-type: none"> • Lava flows and ash fields • Lower altitude peaks • Man-made cloud forest (green mountain) 	To be defined

Table 13 – Selected ecosystem services based on the workshops.

	Ecosystem service	Falkland Islands	Ascension	SGSSI
Provisioning	• Fisheries	X	X	X
	• Fresh water	X	X	
	• livestock production	X		
	• Energy and fuel production	X		
	• Food production (no livestock and fisheries)	X		
	• Construction materials		X	
Regulating	• Carbon sequestration	X	X	X
	• Microclimate control (to be further defined)		X	
Cultural	• Tourism	X	X	X
	• Biodiversity (existence value)	X	X	X
	• Local culture and recreation	X	X	
	• Research		X	X

Before moving to Step II of the analysis, it is advised to:

- Coordinate final selection of both ecosystems and ecosystem services with relevant stakeholders to make sure the selection is inclusive.
- Define beneficiaries that depend on each ecosystem service. Although various stakeholders were identified on all islands, these were not properly linked to the selected ecosystem services in the workshops.

Step II: Defining valuation methods

Step II in the project process focuses on the collection of data and defining the valuation techniques. Various scientific methods⁷ are available to conduct the valuation of ecosystem services. Based on the ecosystem services that have been identified so far, the following valuation techniques are advised⁸:

- **Production function / net factor income method:** with this method, the value of the ecosystem services is determined by determining its value as an input in the production process of an economic activity. Especially for ecosystem services that require substantial other production factors (e.g. capital, labor), this is an appropriate valuation technique. It is advised to use the production function method for the valuation of the following ecosystem services:
 - Fisheries
 - Livestock production
 - Food production
 - Tourism
- **Market price method:** The market price method can be applied if the market price reflects the value of the ecosystem service provided. The market price method can be used for the valuation of:
 - carbon sequestration.
- **Replacement costs method:** This valuation method can be used if an appropriate replacement is available for the ecosystem goods and services. For example, fresh water could be desalinated if reservoirs run dry. However, this would increase user costs. The increase in costs due to the missing ecosystem service is seen as the value of the ecosystem service. It is advised to use the replacement costs method for the following ecosystem services:
 - Water provisioning
 - Construction materials
- **Travel costs method:** The travel costs method can be applied if the beneficiaries' efforts to make use of an ecosystem service are representative of its value. For this study, it is advised to apply the travel costs method to determine:
 - The economic value of research
- **Contingent valuation:** If no market or costs data is available for the valuation of ecosystem services, the contingent valuation method can be applied. Through surveys, the willingness to pay (WTP) of beneficiaries for the provisioning of ecosystem services is determined. It is likely that a contingent valuation approach needs to be applied to value the following ecosystem services:
 - Tourism
 - Local culture and recreation
 - Biodiversity

⁷ For more information on the selected valuation methods, please refer to Waite et al. (2014), p36-41: <http://www.wri.org/publication/coastal-capital-guidebook>.

⁸ Please note that the valuation techniques can be changed if insufficient data is available.

Step III: Data collection

Based on the selected valuation techniques, data requirements can be identified. Appendix 4 provides an overview of the data requirements that follow from the valuation techniques (Table 14 & Table 15). The first step in the data collection process is to collect available data and information from existing data sources and literature (**secondary data**). Table 14 provides an overview of the data that has been identified so far. From this table it can be concluded that there are currently significant data gaps. It is crucial that an extensive secondary data search is conducted to create a comprehensive overview of existing data.

After the search for secondary data, another data gap analysis will be conducted to identify the existing knowledge gaps. The data gaps will most likely limit SAERI's ability to proceed with the valuation methods as specified in this report. The data gaps can be resolved by conducting **primary data collection**. However, primary data collection is a time-consuming and costly exercise. It is therefore unlikely that all data gaps will be resolved.

Most likely, data to support the contingent valuation methods will be lacking. This means that the following surveys could be implemented to deal with foreseen data gaps:

- **Household surveys** among residents of the Falkland Islands and Ascension to identify the use of natural resources and WTP for the provisioning of ecosystem services.
- **A household survey** among citizens of the United Kingdom to identify WTP for conservation of nature in the South Atlantic Territories.
- **A tourist exit survey** among visitors to the Falkland Islands, SGSSI and Ascension to identify WTP for ecosystem services and determining tourist expenditures.

Step IV: Socio-economic valuation

The main objective in this phase is to apply information collected in step II to determine the baseline value of ecosystem services provided on the Falkland Islands, Ascension and SGSSI. Values should be calculated on an annual basis.

If time series data is available, the expected future value of ecosystem services can be estimated. If sufficient spatial information is available on the distribution of ecosystems and land-use, maps can be developed to highlight the relative importance of natural areas in the ecosystem services provisioning.

Step V: Application of valuation results in decision-making tools

The main aim of the project would be to conduct an analysis and produce transparent information for policy makers to develop integrated development strategies and regulatory measures to balance economic activities that benefit from natural capital (e.g. tourism, fisheries and research). By providing a clear picture of the importance of ecosystem goods and services, the pilot studies can support more awareness and information to sustainably manage natural resources.

During the workshops, special emphasis was given on how natural capital valuation results can be used to develop clear policy and regulatory measures for nature

management. The following tools could be applied to support the relevant policy questions that were mentioned as relevant on each island:

- **Scenario analysis:** By analyzing the development of ecosystem services over a long period of time under different scenarios, insight is created in how the future value of ecosystem services can change. The following topics can be assessed in a scenario analysis:
 - The effects of climate change on ecosystem services on SGSSI
 - The effects of long-term economic planning scenarios on ecosystem services on Ascension
 - The effects of the Economic Development Strategy (EDS) on ecosystem services on the Falkland Islands.
- **Cost-benefit analysis (CBA):** In a CBA, costs of an intervention or investment are compared with benefits over a period of time. The following topics can be assessed in a CBA:
 - Comparing the economic effects of different investments in conservation on SGSSI
 - The socioeconomic return on investments in improved waste management on Ascension
 - The socioeconomic return on investments in additional biosecurity measures on the Falkland Islands.
 - Comparing the socioeconomic effects of infrastructure development on Ascension
- **Value mapping:** By analyzing the spatial distribution of ecosystem services, insight is created in the efficiency of spatial planning. Value maps were seen as important inputs to the marine and terrestrial spatial planning processes on all three territories.

Step VI: Preparation and dissemination of Final Results and Report

Once the data evaluation has been completed, it is important to develop technical reports to guide the resource management process. To make policy makers and government officials aware of the outcome, communication materials such as accessible policy briefs are recommended. Furthermore, a final workshop could be organized to inform stakeholders about the study results. To inform the general public, media coverage can be arranged through press releases about the project. Potentially, a documentary is a strong medium to communicate about the value of natural capital in the South Atlantic.

Appendix 1 - Participants

Falkland Islands

<i>Last name</i>	<i>First name</i>	<i>Organization</i>
Baigorri	Daniela	SAERI
Baker	Helen	JNCC
Barton	John	Falkland Islands Government
Bayley	Daniel	SAERI
Brewin	Paul	Government of South Georgia & the South Sandwich Islands
Cockwell	Sam	Public Works Department (Water), Falkland Islands Government
Cotter	Jackie	Falkland Islands Fishing Association
Golding	Neil	SAERI
Guzman	Amílcar	Wolfs Company
Hancox	Emily	Department of Mineral Resources, Falkland Islands Government
James	Ross	Department of Agriculture, Falkland Islands Government
McNeill	Teresa	SAERI
Middleton	Stephanie	Tourism Board, Falkland Islands Government
Pitaluga	Nick	Rural Business Association
Randhawa	Haseeb	Fisheries Department, Falkland Islands Government
Rendell	Nick	Environmental Planning Department, Falkland Islands Government
Saunders	Anne	JNCC
Schep	Stijn	Wolfs Company
Spink	Roger	Falklands Conservation
Tara	Pelembe	SAERI
Taylor	Nikki	JNCC

Ascension

<i>Last name</i>	<i>First name</i>	<i>Organization</i>
Airnes	Andrew	Ascension Government
Andrews	Kenickie	Ascension Government
Baker	Helen	JNCC
Benjamin	Megan	Ascension Government
Brown	Judith	Ascension Government
Councillor Dennis		Ascension Government
Downes	Kate	Ascension Government
Foreman	Jeff	Ascension Government
Fowler	Nathan	Ascension Government
Guzman	Almicar	Wolfs Company
Hawkins	Dale	US Airforce
Haworth	Michael	Ascension Government
Hobson	Johnny	Ascension Government / Obisidian
Holland	Rachel	Ascension Government
Leat	Eliza	Ascension Government
Mason	Jamie	Ascension Government
McNeill	Teresa	SAERI
Mrowicki	Robert	Ascension Government
Pelembe	Tara	SAERI
Pritchard	Matthew	Ascension Government
Schempp	Daniel	US Airforce
Schep	Stijn	Wolfs Company
Sim	Jolene	Ascension Government
Stritch	John	Ascension Government
Williams	Natasha	Ascension Government

South Georgia & the South Sandwich Islands

<i>Last name</i>	<i>First name</i>	<i>Organization</i>
Baker	Helen	JNCC
Brewin	Paul	Government of South Georgia & the South Sandwich Islands
Guzman	Amílcar	Wolfs Company
Tara	Pelembe	SAERI
Saunders	Anne	JNCC
Schep	Stijn	Wolfs Company

Appendix 2 - References

- FIG Environmental Planning Department. (2016) Falkland Islands Biodiversity Framework 2016 – 2030.
- Government of South Georgia & the South Sandwich Islands (2016) *Biodiversity Action Plan for SGSSI 2016-2020*
- Tierney, M., Brauneder, k., Bowles-Newark, N., and Wilson, L. (2013) Scoping the feasibility of undertaking an ecosystem assessment for South Georgia Island & the Falkland Islands, report to the Darwin Initiative UK Overseas Challenge Fund.
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- Millennium Ecosystem Assessment. (2005) Ecosystems and human well-being: synthesis. Washington, DC: Island Press. ISBN 1-59726-040-1.
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Appendix 3 - Slides

Please see the PDF files with the workshop presentations attached to this report.

Appendix 4 – Data requirements and preliminary data gap analysis

Table 14 – Data required for ecosystem services valuation. *Green* = available data; *orange* = might be available; *red* = unknown / not available.

	Category	Potential valuation techniques	Type of data	Falkland Islands	Ascension	SGSSI
Provisioning services	Fisheries	Production function	<ul style="list-style-type: none"> Local fish prices Commercial fish catch (ideally species specific) Catch of subsistence/recreational fisheries (species specific) Fishing effort & costs of different types of fishermen Number of fishermen/boats (recreational, subsistence and commercial) Data on value chain (e.g. fish processing) Charter fishing data 	Department of Fisheries, FIFCA	Data should be available through the charter boat operators	All data regarding fisheries on SGSSI is available through the Government of SGSSI. Costs may be acquired through fishing companies
	Water provisioning	Replacement cost method	<ul style="list-style-type: none"> Water demand Water supply and availability Water prices Costs for maintenance of water provisioning infrastructure and any other operating costs Costs of water purification 	Public Works Department, Spatial Planning Department, Statistics Office	Might be available through Public Works Department, Spatial Planning Department, Statistics Office	
	Livestock production	Production function	<ul style="list-style-type: none"> Meat production per year Wool production per year # livestock per year Production costs Agricultural land 	Department of Agriculture, Wool companies, land owners, FIMCO		

	Category	Potential valuation techniques	Type of data	Falkland Islands	Ascension	SGSSI
	Food production (other than livestock and fisheries)	Production function	<ul style="list-style-type: none"> • Crop types and total production per year • Production costs 	Might be available through Department of Agriculture		
	Construction materials	Production function	<ul style="list-style-type: none"> • Quantity of different materials used • Extraction costs • Estimated value of replacement import materials 			
	Energy and fuel production	Production function	<ul style="list-style-type: none"> • Annual peat production • Potential oil production • Harvesting costs • Market prices 			
Regulating services	Microclimate control	<i>To be further defined</i>	<ul style="list-style-type: none"> • <i>To be further defined</i> 			
	Carbon sequestration	Market based valuation	<ul style="list-style-type: none"> • Biomass stored in different habitats (i.e. most relevant carbon pools) • Area of relevant habitats for carbon sequestration or carbon pools • Carbon trade prices 			
Cultural services	Tourism	<i>Production function approach</i>	<ul style="list-style-type: none"> • Tourist arrival statistics • Tourist WTP for nature conservation 	Department of tourism	Department of tourism	Government SGSSI
		<i>Contingent valuation</i>	<ul style="list-style-type: none"> • Revenues / tourist expenditures • Costs structure of the tourism industry • Tourism activities during stay (spatial component) 			
	Local culture	<i>Contingent</i>	<ul style="list-style-type: none"> • WTP of residents for nature conservation 	Some participatory		

	Category	Potential valuation techniques	Type of data	Falkland Islands	Ascension	SGSSI
	and recreation	<i>valuation</i>	<ul style="list-style-type: none"> • Recreational activities • Demographics • Cultural & recreational areas (identified through participatory mapping or other techniques) 	mapping on relevant natural locations might be available (source unknown)		
	Research value	<i>Travel costs method</i>	<ul style="list-style-type: none"> • Research statistics • Grants or other type of funding allocated to local research • Locations/ecosystems/habitats/species of interest for research 			Government SGSSI, British Antarctic Survey (BAS)
	Biodiversity: existence values	<i>Contingent valuation</i>	<ul style="list-style-type: none"> • WTP of overseas residents for nature conservation (survey data) • Actual money spent on nature conservation by foreign organizations 			

Note 1: where available, collect time-series and data with a spatial component

Note 2: Data list will change after scoping in the first stage of an ecosystem service valuation project

Table 15 - Data required for to assess the state and extend of ecosystems. *Green* = available data; *orange* = might be available; *red* = unknown / not available.

	Category	Potential valuation techniques	Type of data	Falkland Islands	Ascension
State of ecosystems	Marine ecosystems	<ul style="list-style-type: none"> Habitat maps Quality (with supporting information on the measurement and estimation of quality) 			
	Terrestrial ecosystems	<ul style="list-style-type: none"> Land cover maps Quality (with supporting information on the measurement and estimation of quality) 		Ascension Nature Conservation	http://www.sggis.gov.gs/
	Biodiversity	<ul style="list-style-type: none"> Stock assesments of species (over time) Endemic and endangered species Distribution of species 			http://www.sggis.gov.gs/
Threats	Land-use	<ul style="list-style-type: none"> Land-use types Spatial distribution of land-use type over time Coastal developments/infrastructure Impact on ecosystems 	Some marine spatial planning data is available		
	Pollution / sedimentation	<ul style="list-style-type: none"> Nutrient loading solid waste Sedimentation / erosion 			
	Invasive species	<ul style="list-style-type: none"> Relevant invasive species Distribution of invasive species Ecological impact 	List of invasive species is available. Distribution is unknown.	List of invasive species is available. Distribution is unknown.	List of invasive species is available. Distribution is unknown.

Note 1: where available, collect time-series and data with a spatial component

Note 2: Data list will change after scoping in the first stage of an ecosystem service valuation project