Strategic Environmental Assessment of Shale Gas Development in the Central Karoo

Phase 3:
Decision Support Tools Report

APPENDIX 2

Bioblitz Closure Report:
Generating New Foundational Biodiversity Information for the Shale Gas SEA

SANBI
Biodiversity for Life
South African National Biodiversity Institute

Bioblitz Closure Report:

Generating New Foundational Biodiversity Information for the Shale Gas SEA

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features and/or features that are important for achieving targets for representing biodiversity and/or maintaining ecological processes. Protected areas, EBIS-1 areas and EBIS-2 areas collectively meet targets for representation of biodiversity and maintenance of ecological processes in the study area. EBIS-3 areas (44% of the study area) are natural areas that do not contain currently known sensitive or important features. In EBIS-4 areas (1% of study area) there is no remaining natural habitat.

1. INTRODUCTION

The Department of Environmental Affairs (DEA) commissioned a Strategic Environmental Assessment (SEA) for Shale Gas Development (SGD) (Figure 1). DEA appointed a project team comprising the Council for Scientific and Industrial Research (CSIR), South African National Biodiversity Institute (SANBI) and the Council for Geoscience (CGS). SANBI's role in the SEA was to provide inputs on the terrestrial and freshwater biodiversity within the study area, and identify the importance and sensitivities of the various species and ecosystems. Due to significant data gaps within the Karoo region, SANBI undertook bioblitzes (rapid biodiversity assessments) in addition to mobilising existing biodiversity data in order to improve the overall understanding of the biodiversity of the this region.

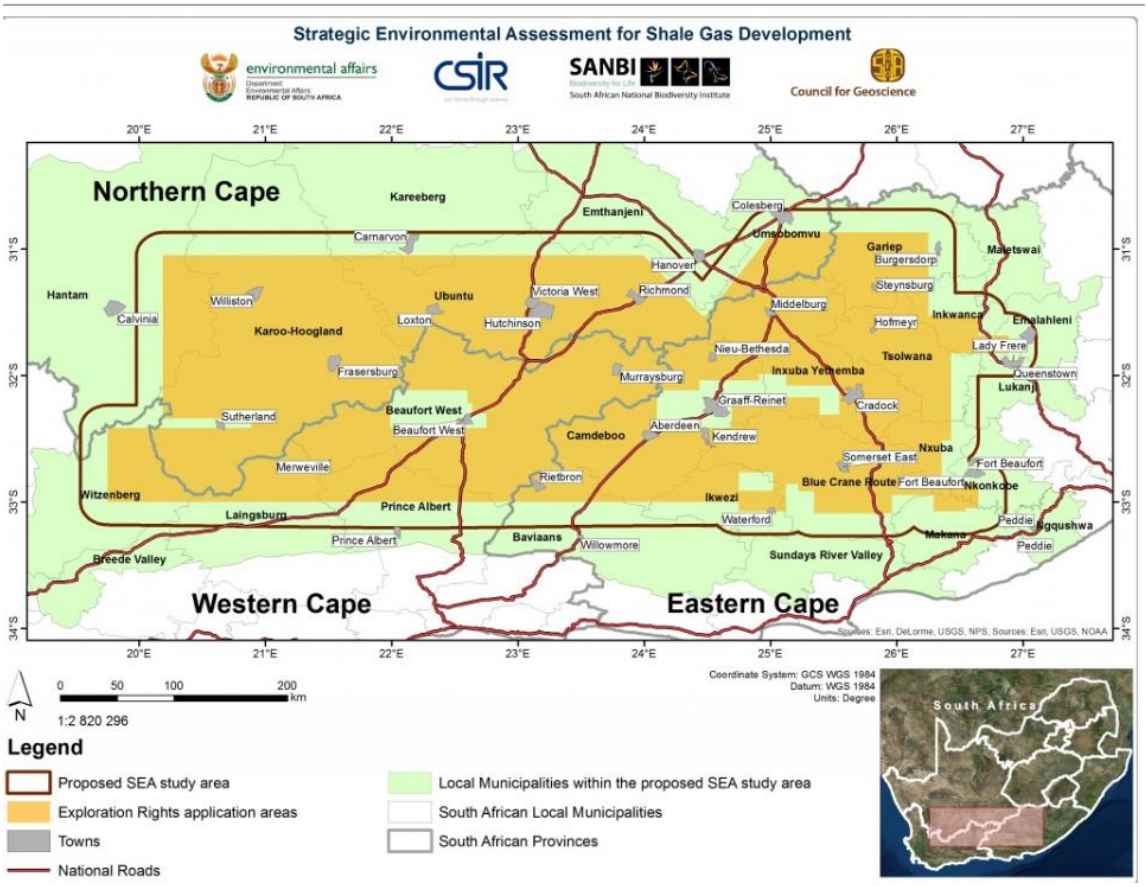

Figure 1: Study area for the Shale Gas Development SEA in the Karoo region

This report focuses firstly on the fieldwork undertaken during the SEA timeframe in the form of BioBlitzes. It also covers the mobilisation of existing collections data and explains how all species data was used in Chapter 7 Biodiversity and Ecological Impacts: Landscape Processes, Ecosystems

and Species (Holness et al. in Scholes, R., et al. (eds.). 2016. Shale Gas Development in the Central Karoo: A Scientific Assessment of the Opportunities and Risks.

2. BIOBLITZES CONDUCTED FOR THE SHALE GAS DEVELOPMENT SEA

The Nama-Karoo biome is one of the most biologically underexplored areas of South Africa. For example, only 3% of plant records of the country come from this region, despite the fact that it occupies nearly 30% of the country's total area. Due to this, part of SANBI's deliverables was to conduct bioblitz exercises to collect data for ten different taxonomic groups within the study area.

THE BIOBLITZ PROCESS

A bioblitz is a process of conducting field surveys at a single site in a short time period (usually one day) with as many observers as possible. Bioblitzes are usually conducted by biologists who are specialists for specific taxonomic groups. Bioblitzes can also involve citizen scientists, and are an excellent opportunity to involve the public in biodiversity surveys.

A challenge about conducting field surveys within the Nama Karoo biome is that the whole ecology of the area is dependent on scarce and variable rainfall. Much of the biodiversity of this region is ephemeral, with many species of plants only flowering after rain. The plants in the Karoo region are only identifiable with flowers. In addition, invertebrate species (especially freshwater invertebrates that occur in ephemeral wetlands) and insect pollinators are not present as adults, but only in larval and egg life history stages, buried underground during dry periods. Sampling during dry spells misses at least 75% of species present in the Karoo.

It was thus imperative that bioblitzes were conducted at the correct time of the year after significant rainfall events. Although funding was received in January of 2015 fieldwork could not start before the SGD SEA was officially launched, this took place in May of 2015. At the start of this SEA, SANBI was given until May 2016 to obtain species data. Unfortunately, the times for submission of species data were brought forward to December 2015 during the first SEA Authors workshop that took place from 28 – 30 September 2015 so that the data could be included in the analysis for the first order draft of the biodiversity chapter. The best rainfall months in the Karoo are February to April. With the changes in timeframes of this project two field seasons were lost. In addition from May to December 2015 there was no rain at all in the Karoo as a result of the El Nino drought experienced across South

Africa. It was therefore not possible to conduct bioblitzes, with experts from all 10 different taxonomic groups. Two fieldtrips were however conducted in August 2015 and December 2015. During these fieldtrips it was clearly apparent that this was not the ideal time to survey for example many of the species present could not be identified.

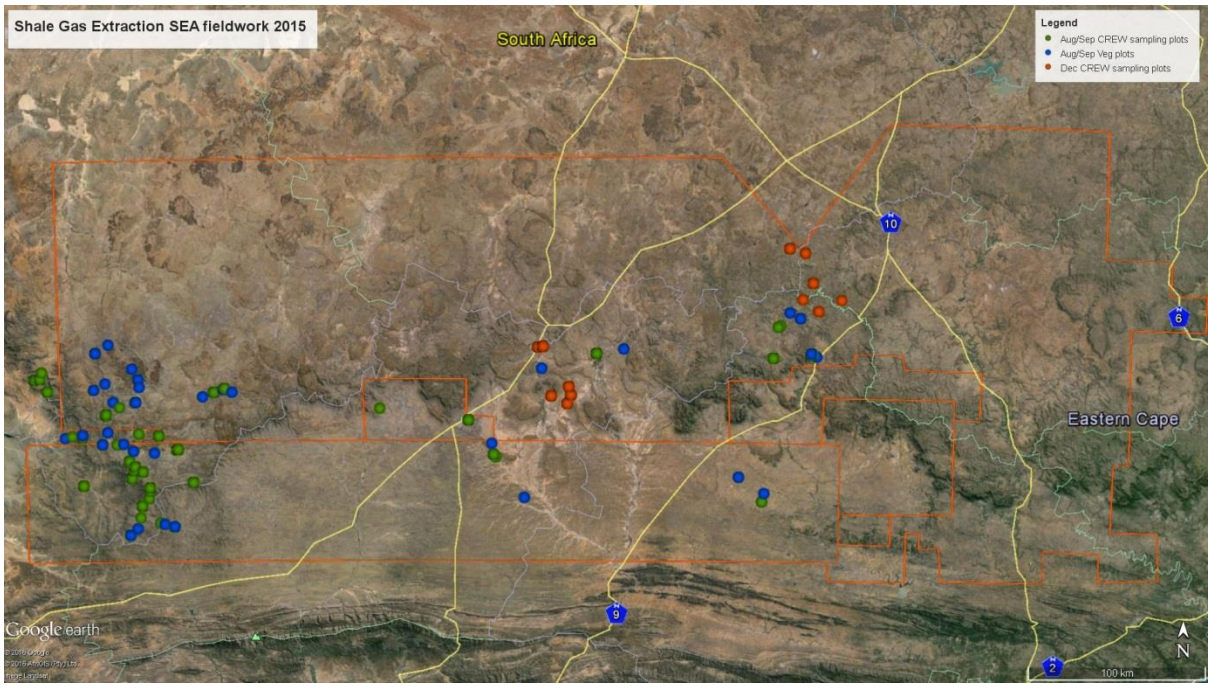

Figure 2: Bioblitzes conducted between August - December 2015 in the study area

A total of 16 days were spent in the field from 25 August – 9 September 2015. Nine days were spent surveying the western section of the SGD study area, in Sutherland, Fraserburg and Tanqua Karoo region, while seven days were spent in the central and western parts of the Karoo. 47 surveys for range restricted endemic and near endemic species were conducted. A total of 183 species was recorded and data was collected for 10 endemic species.

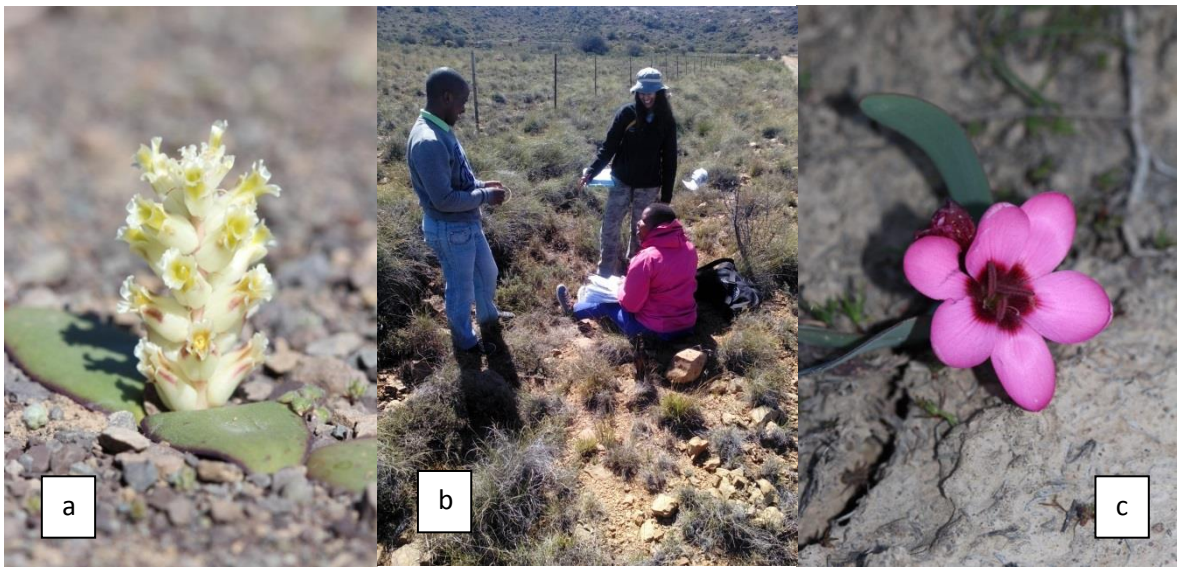

Figure 3a. *Lachenalia congesta*, a range restricted rare species endemic to the western section of the SGD study area, b. conducting bioblitzes in the field, c. *Heasperantha humilis*, a range restricted species from the Sutherland area

During December 2015, four days were spent in the field, despite the fact that no rain had been received. The focus of the field work was the eastern section of the study area stretching from Graaff-Reinet towards Beaufort West. Through mapping range restricted endemic and near endemics, it was apparent that the mountainous areas between the Roggeveld and Camdeboo regions are key hotspots for plants, however there are major information gaps for the lowlands. Efforts were taken in these lowlands areas as these areas might be the main focus should there be any shale gas development in the area. Due to the drought, many of the species were either not flowering (plants), or were dormant (animals). Despite this, 15 sites were surveyed and 45 species were recorded and data was collected on 4 endemic species.

Figure 4a. *Geranuim harveyi*, b. *Monsonia camdeboensis*, c. *Moraea crispa* three range restricted endemic species from the Eastern and Central section of the study area

In order to address the situation that all species data was to be submitted into the SEA process in December 2015, but that funding to conduct fieldwork from DEA stretched to May 2016, in March and April 2016 further surveys were done in the Karoo BioBlitz funding. Spiders, reptiles and plants were the focus of this fieldwork. The data collected were channelled into the larger Karoo BioGaps project detailed below.

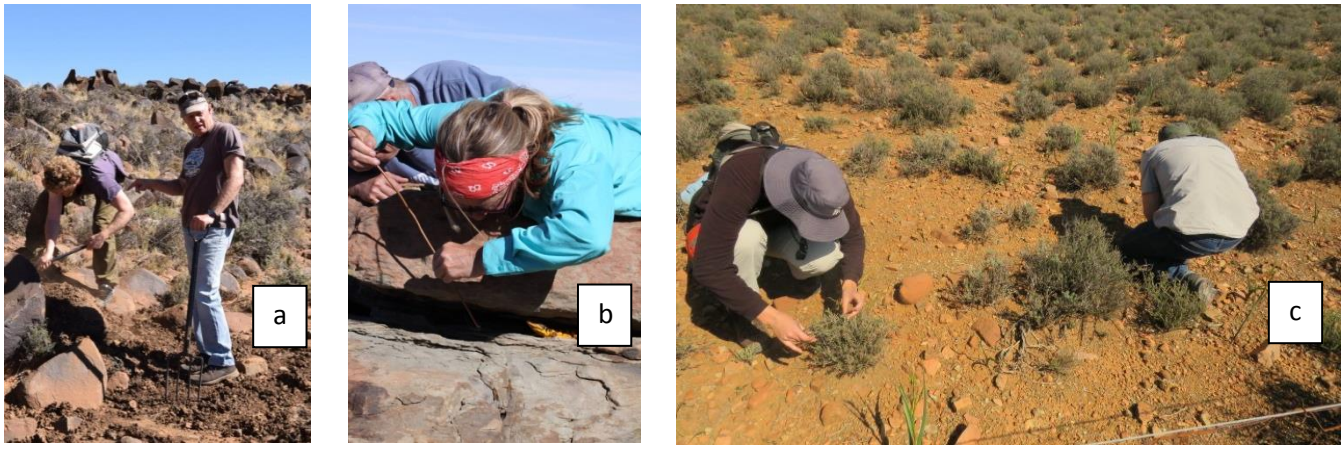

Figure 5: Fieldwork for Reptiles (a & b) and for plants and insects (c).

In addition, SANBI hosted a BioBlitz involving members of the public. The BioBlitz was held on Saturday 16 April 2016 near to Matjiesfontein in the Karoo. Over 70 people attended this BioBlitz and amongst others included community members from Beaufort West, individuals who had registered as interested and affected parties for the Karoo Shale Gas Strategic Environmental Assessment and government officials from the Department of Science and Technology, the Department of Minerals Resources, and the Northern Cape and Western Cape conservation agencies. Participants were guided by taxonomic experts on how to collect specimens of the different animal and plants groups that occur in the Karoo. Following a full day in the field, specimens were processed and an opportunity was provided to participants to learn how to process invertebrate and plant specimens.

Figure 6: The Karoo BioBlitz awareness day that took place in April 2016 involving members over 70 participants that ranges from community members to government officials (a& b). Participants were involved in surveying seven taxonomic groups shown here surveying for butterflies (c), collecting spiders (d) and identification of specimens (e).

Valuable observations of plants and animals were gained during the Karoo awareness BioBlitz and it started a citizen science engagement in the Karoo where citizens post their images of plants and animals onto the iSpot Citizen Science Portal, as part of the Karoo BioGaps project (detailed below) this project can be found at the following link http://www.ispotnature.org/projects/karoo-biogaps/observations/map. To date 4298 observations have been included on this portal. SANBI is in the process of engaging experts in identifying these postings so that citizen science observations can contribute to the overall datasets of animal and plant distributions feeding into decision making in the Karoo.

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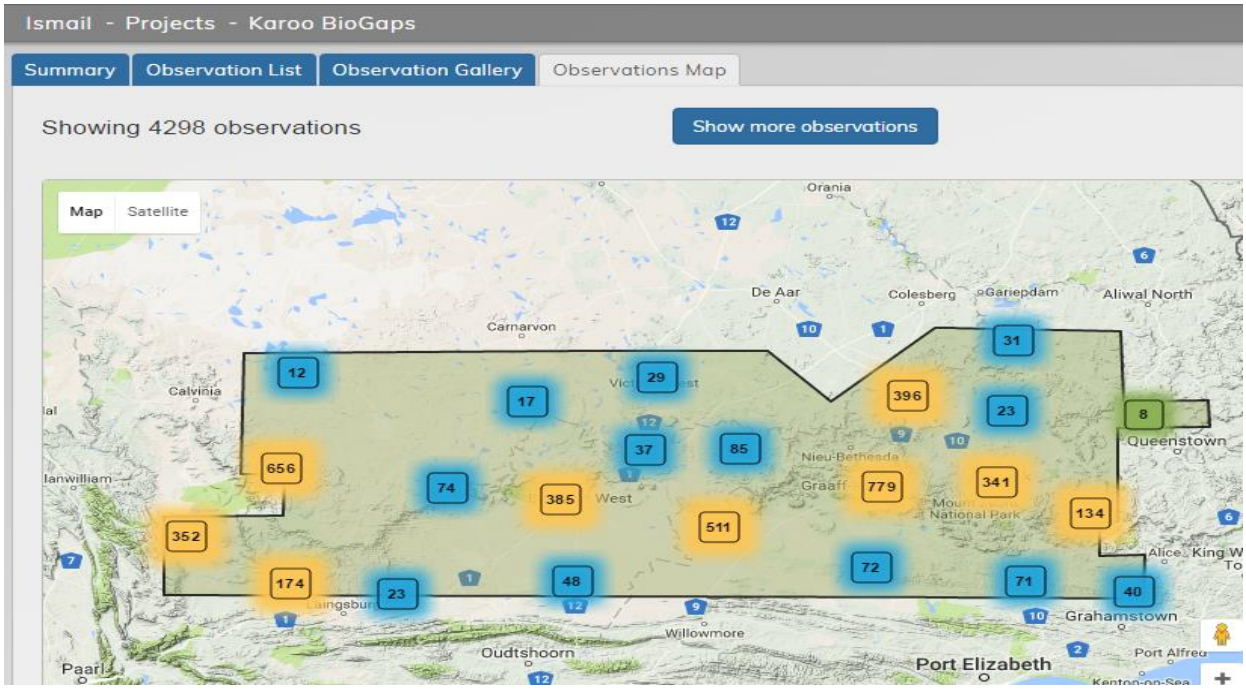

Figure 7: A screenshot image showing the number of citizen science observations posted for the Shale Gas Development Zone to date.

3. THE KAR00 BIOGAPS PROGRAMME AND FUTURE RESEARCH STIMULATED BY THE SHALE GAS SEA

During the process of conducting BioBlitzes and accumulating and assessing existing biodiversity data for the SGD SEA, a more nuanced understanding of the information gaps and biases was developed for Karoo plants and animals. The difficultly of thoroughly surveying the karoo in a one year period, due to the ephemeral nature of the species response to water availability was highlighted during the 2015 fieldwork. As a result, SANBI led a consortium of 18 collections and research institutions to secure funding from the National Research Foundation's (NRF) Foundational Biodiversity Information Programme (FBIP) for a three-year project entitled "BioGaps: Filling biodiversity information gaps to support development decision making in the Karoo" (referred to as "Karoo BioGaps Project").

The Karoo BioGaps Project aims to mobilise foundational biodiversity data to support the SEA for shale gas development and other potential infrastructure development projects in the Karoo basin. The current paucity of biodiversity data will be addressed through:

- integrating and upgrading existing species data located in museums and herbaria, and

- conducting detailed surveys for 12 representative taxonomic groups in areas targeted for shale gas exploration.

The 12 taxonomic groups are: plants, birds, mammals, fish, amphibians and reptiles; as well as six invertebrate groups: bees, dragonflies, grasshoppers, scorpions, butterflies and spiders. The BioBlitzes started during the SEA project will be continued until mid 2018.

50 Pentads that represent the climatic, edaphic, geographic and topographic variation of the Karoo have been selected by the by University of Cape Town's Centre for Statistics in Ecology, the Environment and Conservation (SEEC), to ensure that the sampling process is scientifically credible. After the first 6 months of field work it has become apparent that the BioGaps taxon leads will only be able to visit and sample the 30 pentads, leaving 20 peripheral pentads that require sampling. The power of statistical analyses to model the distribution and occupancy of species needed to feed into land-use decision making is significantly decreased if data from only 30 sites/pentads are utilised. Volunteer citizen scientists are thus being engaged to sample 20 pentads through conducting a further series of BioBlitz field trips. A minimum of 6 volunteers will carry out sampling in the focal pentads during each BioBltiz. BioBlitzes as part of the Karoo BioGaps project start in February of 2017.

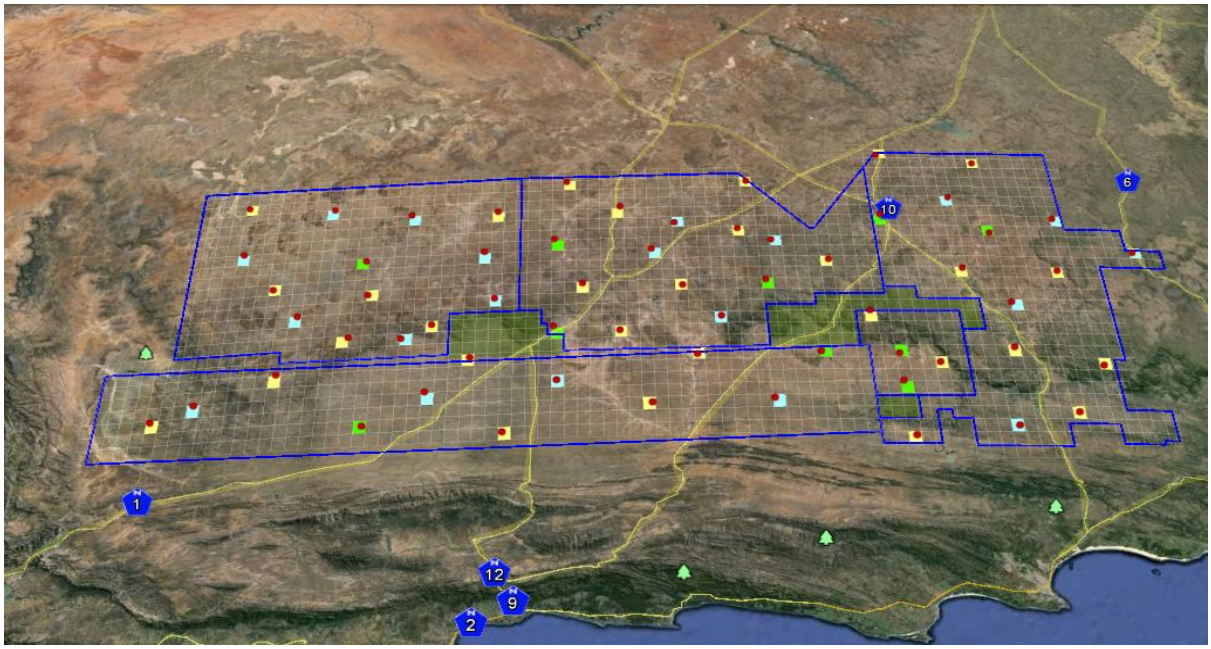

Figure 8: The randomly sampled statistically representative sample pentads for the Karoo BioGaps project. The yellow pentads represent the 30 pentads for where the taxon experts will sample, while the blue pentads will be sampled by citizen scientists. Green pentads are 10 additional sites that will be sampled for plant diversity only as part of SAEON's (South African Earth Observation Network), one of the project partner's, aims to effectively monitor the biodiversity of the Karoo.

4. MOBILISATION OF HISTORICALLY COLLECTED PLANT AND ANIMAL DISTRIBUTION DATA FOR USE IN THE SHALE GAS SEA

The first step to mobilising historic distribution data was to identify which plant and animal species of conservation concern occur in the Karoo. This exercise relied on extensive consultation of literature as well as bringing together various taxonomic experts of the Karoo region to assess historic data that could be used in the biodiversity assessment component.

4.1 Plants

There are over 7000 plant species occurring in the study area (Figure 1) for the shale gas development SEA. The approach was to first identify which plants are of conservation concern. Through discussions with the Karoo experts, plant species that have either 80% or their entire global range (near endemic) or that occur entirely (endemic) within the study area for the shale gas development SEA were selected as plant species of conservation concern. Endemic and near endemic plants were identified by checking all plants listed in the three regional flora's that cover the SGD study area (Snijnam, 2013, Maggee & Boatwright, in prep, Bredenkamp, in prep).

There are a total of 193 endemic and near endemic plants species that occur within the study area. Of these, 20 plants are too poorly known (no recent collections of these species exist) to be included in a spatial prioritisation plan. About 57 plants (Figure 9) are locally common and widespread within this area and are not likely to lose a significant proportion of their population to shale gas development, even under the large scale production scenarios. About 119 near endemic and endemic plants (Figure 10) have ranges and habitat requirements that are narrow and specific and likely to be threatened with extinction if there is large scale development. These species are of conservation concern and the area(s) of their concentration need to be avoided should there be shale gas development.

Occurrence records for each of these endemic and near endemic plants were gathered from SANBI's Botanical Research and Herbarium Management System (BRAHMS). All the records were not spatially geo-referenced. Four SANBI contract staff spent four months on geo-referencing about 2431 records obtained from herbarium specimens. Additional records were also obtained from the scientific literature (species descriptions and ecological studies). A spread sheet of all endemics and near endemics plants, along with their associated habitat preferences was produced and verified by experts during a workshop held on the 17-18 November 2015. All the occurrence records were fed into the spatial planning component of the Biodiversity chapter of the SEA.

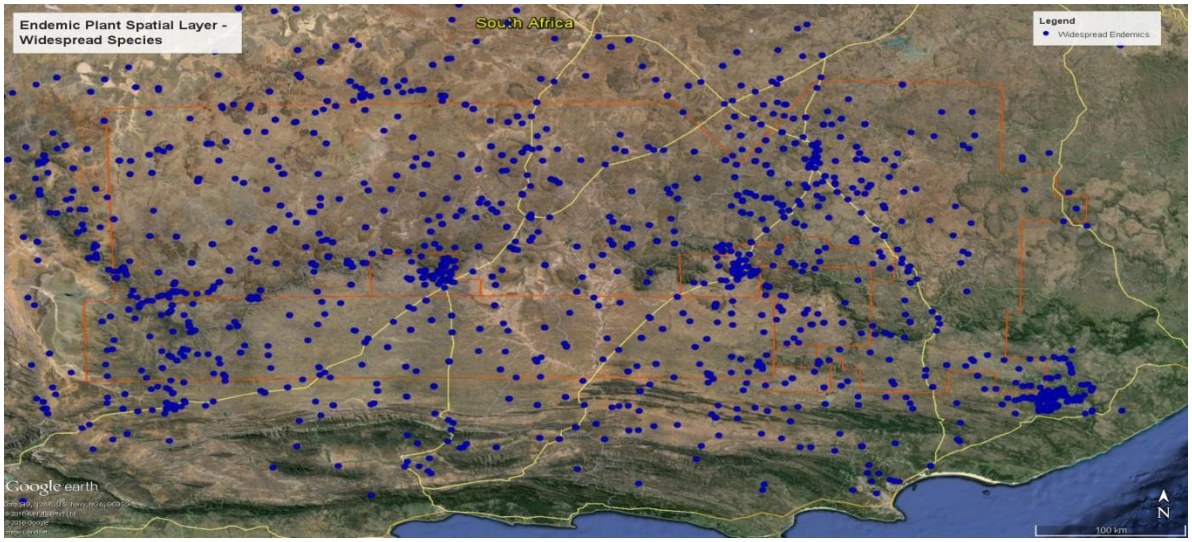

Figure 9: Distribution records of 57 plants species that are either endemic or near endemic that are common and widespread in the study area

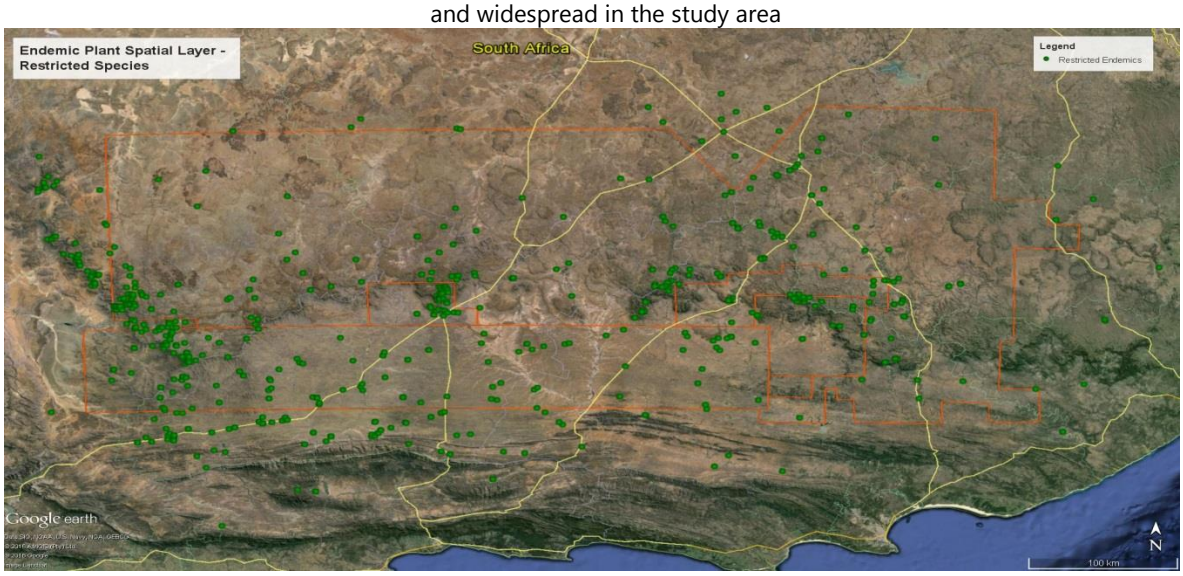

Figure 10: Restricted distribution range of 119 endemic and near endemic plant species in the Shale Gas Development study area

4.2 Animals

Two expert workshops were held, the first on the 5 June 2015 and the second one on the 17-18 November 2015 to identify animal species of conservation concern and to discuss which groups to include in the biodiversity assessment component. Species of conservation concern were considered as:

- Those that are endemic or largely endemic to the study area (>60% of distribution range in the study area)

- Those that are threatened and occur in the study area (threatened at a global level as per the IUCN). Only species that are relatively well known in terms of taxonomy and distribution were considered.

Below are the species of conservation concern that fed into the systematic biodiversity spatial plan of the SEA:

Mammals: Black-Footed Cat (Vulnerable) and Riverine Rabbit (Critically endangered); Sclater's Golden Mole (subspecies *Chlorotalpa sclateri shortridgei* (endemic to the study area)); *Elephantulus pilicaudus* (near endemic to the study area).

Birds: While there are no species endemic to the study area, and no threatened species occur in the focus area, species listed are endemic or near endemic to South Africa, and occurring in the focus area were included as priority birds. The following birds were included as priority species - Grey-wing falcon, Ground woodpecker, Blue korhaan, Karoo prinia, Namaqua warbler, Large-billed lark, Sickle-winged Chat, Southern double-collared sunbird, African rock pipit. In addition, a nesting colony of Cape Vultures in the study area has been flagged.

Reptiles:
Threatened species endemic to the focus area are Plains Mountain Adder (Endangered); and two species are near threatened: Karoo padloper and Braack's Pygmy gecko. An additional five species / subspecies are not threatened, but are endemic / near endemic to the focus area are also considered to be species of special concern (Cloete's Girdled Lizard, *Pseudocordylus microlepidotus namaquensis (*no common name) , Karoo Flat Gecko, Western Dwarf Girdled Lizard and Thin-skinned Gecko.
Amphibians: There are no threatened species in the study area; however there is one near endemic amphibian species of conservation concern, *Cacosternum karroicum*, in the study area.

Freshwater fish: There are five fish species that are endemic / near endemic, and that are threatened. These are the Eastern Cape redfin (*Pseudobarbus afer*), Amatola barb (*Barbus amatolicus*), Border barb (*Barbus trevelyani)* and the Cape rocky (*Sandelia bainsii*).

Invertebrates: There are two Anostraca species (fairly shrimp) that are known only from the Karoo region, seven terrestrial mollusc species (endemic or near endemic), one millipede species (endemic), 19 butterfly species (endemic or near endemic) of which one species is considered threatened and

seven species are considered rare. There are six locust species thought to be endemic / near endemics, and two damselfly species that are endemic and threatened.

A total of 12, 000 records of animals occurring in the Karoo region were sourced from experts who took part in the data collection process. After the process of consultation, a total of 993 animal records (Figure 11) were fed into the systematic biodiversity spatial plan component of the biodiversity assessment.

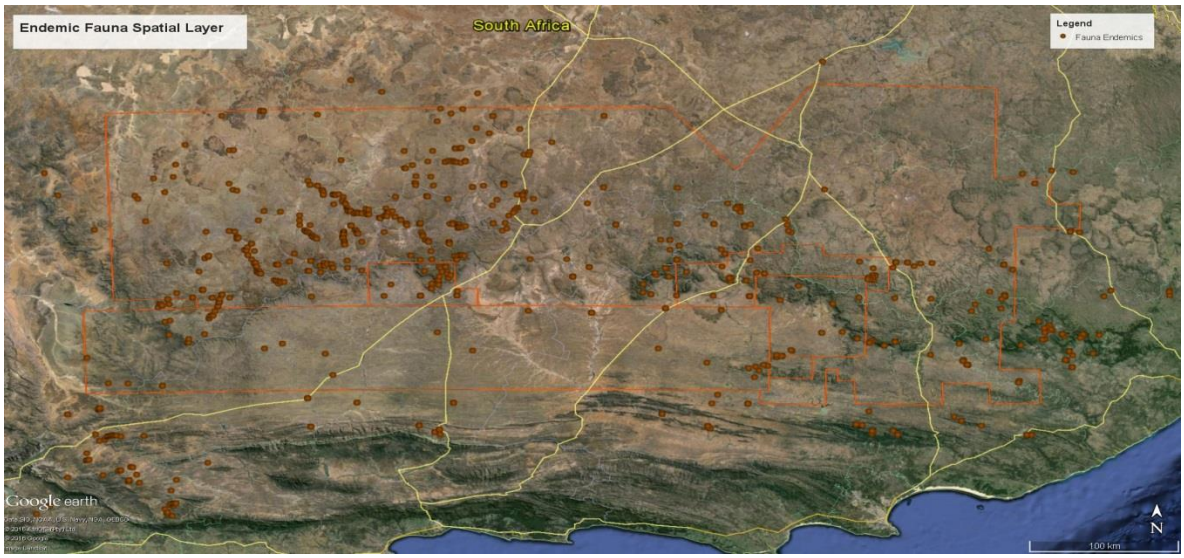

Figure 11: Distribution of animal species that are either endemic or near endemic in the study area

5. HOW THE DATA HAS BEEN USED TO UPDATE RELEVANT ENVIRONMENT SURFACES

5.1 Use of data for Shale Gas Development Strategic Environmental Assessment.

Accurate point distribution records for species of conservation concern identified and mobilised as described above were fed into the spatial prioritisation conducted as part of the Biodiversity component of the SGD SEA. 119 range-restricted plant species, and 12 globally threatened animal species have been recorded from the study area, with 2431 plant records (for the 119 range restricted species) and 993 animal records (for the 12 globally threatened animals) feeding into the spatial sensitivity analysis.

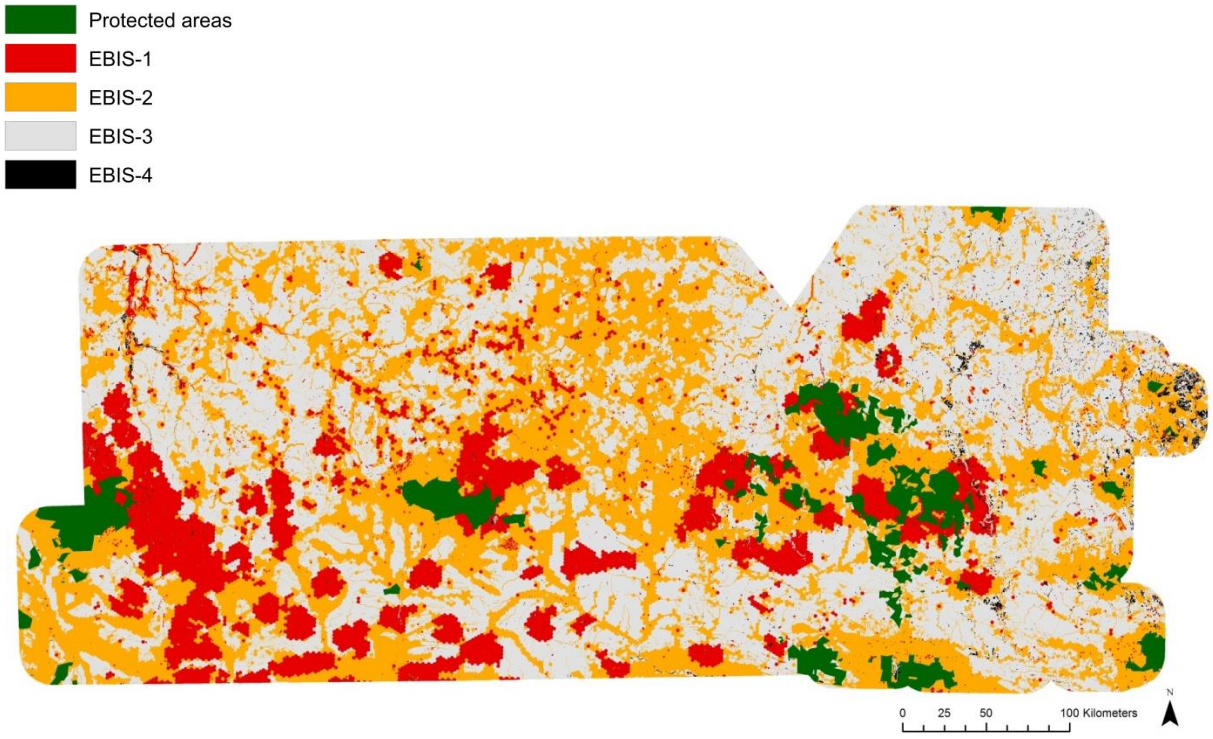

Figure 12: Map of Ecological and Biodiversity Importance and Sensitivity (EBIS) in the study area. Protected areas (5% of study area) are legally protected. EBIS-1 areas (13% of study area) contain extremely sensitive features and are irreplaceable. EBIS-2 areas (37% of study area) contain highly sensitive features and/or features that are important for achieving targets for representing biodiversity and/or maintaining ecological processes. Protected areas, EBIS-1 areas and EBIS-2 areas collectively meet targets for representation of biodiversity and maintenance of ecological processes in the study area. EBIS-3 areas (44% of the study area) are natural areas that do not contain currently known sensitive or important features. In EBIS-4 areas (1% of study area) there is no remaining natural habitat.

In the spatial sensitivity analysis for the SGD SEA four levels of Ecological and Biodiversity Importance and Sensitivity (EBIS) were identified. Species of conservation concern were used to identify the areas of highest ecological and biodiversity importance and sensitivity EBIS-1 (Figure 12).

EBIS-1 are defined in the analysis as areas that contain extremely sensitive features, such as key habitat for rare, endemic or threatened species, or features that perform critical ecological functions. These sites are irreplaceable (i.e. no ecologically equivalent sites exist and there is no exchangeability between sites). The land-use guideline recommendation for these areas are that SGD activities must be avoided, as impacts of SGD in these areas would undermine the ecological integrity of the Karoo. Ideally these areas should be secured through appropriate zoning, development controls, or protected area expansion through stewardship and other mechanisms.

5.2 Use of data for future land-use decision making for the Karoo Region.

All species distribution data collected during the Bioblitzes for the SGD SEA as well as the data currently being collected for 12 taxonomic groups working as part of the Karoo BioGaps project will be supplied to the University of Cape Town's Centre for Statistics in Ecology, the Environment and Conservation (SEEC). Species occupancy modeling will be conducted by scientists working at SEEC. The Karoo BioGaps project team will develop a range of landuse guidelines linked to the likelihood of a species of conservation concern being predicted by the models to occur in different areas of the karoo. These data will feed into the land use decision support as part of DEAs screening tool for Shale Gas Development.

The data collected and georeferenced through the SGD bioblitzes as well as the data that is and will continue to be collected and georeferenced through the Biogaps project will be added to the existing data sets for the relevant taxonomic groups. Plot data collected also gets added to the veg map database, which helps in refining SANBIs vegetation boundaries in support of the updates to the National Vegetation Map. During the bioblitzes, wetland verification and ground- truthing for the SGD area was also done as one of SANBI's wetlands team as well as desk top verification by the wetlands specialist on the Biodiversity Chapter of the SEA. This wetland data, as well as all the data digitised and improved on for Shale Gas SEA is being used to improve and inform the national wetland map, which will be relied on heavily in DEAs Screening Tool and forms part of the national wetland inventory for the National Biodiversity Assessment 2018.