Darwin Initiative: Final Report

*To be completed with reference to the "Writing a Darwin Report" guidance: (http://www.darwininitiative.org.uk/resources-for-projects/reporting-forms). It is expected that this report will be a **maximum** of 20 pages in length, excluding annexes)*

Darwin Project Information

Project reference	23-031
Project title	Science-based interventions reversing negative impacts of invasive plants in Nepal
Host country(ies)	Nepal
Lead organisation	Royal Botanic Garden Edinburgh, UK
Partner institution(s)	Nepal Academy of Science and Technology (NAST), Department of Plant Resources, MoFSC, Central Department of Botany, Tribhuvan University, HELVETAS Swiss Interco-operation, Nepal
Darwin grant value	£ 293,585
Start/end dates of project	June 2016-May 2019
Project leader's name	Dr Mark F Watson
Project website/blog/Twitter	www.invasiveplantsnepal.org;
Report author(s) and date	Mark Watson, Bhaskar Adhikari, Lila Nath Sharma, Ekananda Poudel, Bharat Babu Shrestha, Shandesh Bhattarai, Birendra Karna, August 2019

1 Project Rationale

The project was designed to develop in-country capacity to tackle the increasing challenges from Alien Invasive Plants Species (AIPS) in Nepal, and to develop methods to utilize them to improve the livelihoods of local people.

Nepal's population of 28 million is predominantly rural, with 69% classified as rural poor, many of whom rely directly on plant resources to sustain livelihoods; 1.9 million are climate vulnerable. Community-based Forest User Groups (CFUGS) strive to manage plants and habitats so that they continue to meet daily needs for food, fodder, shelter, fuel, medicine, etc. Project partner engagement with rural communities has shown that invasive plants threaten livelihoods and wellbeing as farmland and forests have become unproductive, and medicinal plants and NTFPs have been lost. In many districts in Nepal communities dependent on natural resources have requested help to control AIPS, restore degraded lands and acquire technologies to convert waste biomass into bioenergy.

The Government of Nepal (GoN) recognises the spread of invasive plants as a 'Key Challenge', and. Nepal's *National Biodiversity Strategy and Action Plan* emphasises the increasing importance and rapid spread of AIPS as a major threat to forest biodiversity and an emerging issue in understanding impacts of climate change. In alignment with Aichi Targets 9 & 15, the Bonn Challenge, and Sustainable Development Goal 15, GoN considers it a 'Strategic Priority' to control the infestation and spread of AIPS and restore degraded lands.

Three districts (Makawanpur, Nawalparasi, Bardiya) were selected for the implementation of the project (See site report: Sup. Doc.1; http://www.invasiveplantsnepal.org/about/project-reports; and map below, Fig.1). Priority actions of the project include:

- Enhancing national capacity for detailed survey and early detection of AIPS,
- Building the knowledge base - filling gaps in botanical identification,
- Producing bilingual manuals on recognition and control,
- Addressing policy gaps for better management of forest resources,
- Raising awareness of local people on identification of AIPS and their impact,
- Providing technical assistance and involving local people in managing AIPS.

.

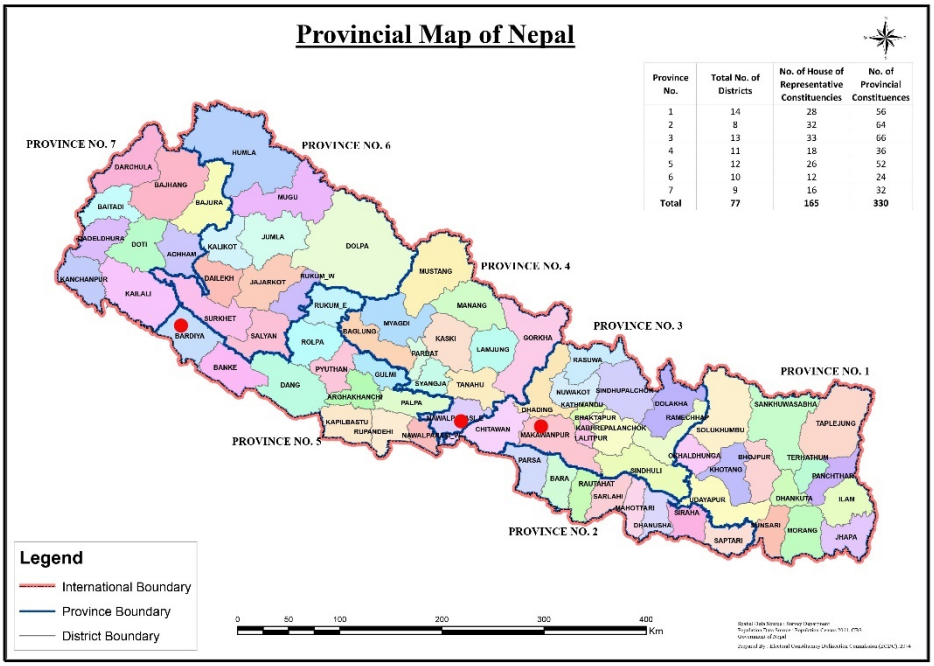

Fig.1. Project sites (red dots) in a new provincial map of Nepal

2 Project Partnerships

The project was led by the Royal Botanic Garden Edinburgh: the team comprised of Project Leader, Dr Mark Watson, Project Deputy-Leader Dr Colin Pendry, Project Officer Dr Bhaskar Adhikari and Dr Martin Pullan (Informatics).

The host country partners were:

1. Nepal Academy of Science and Technology (NAST)
nast.gov.np
NAST was the lead organisation with responsibility for in-country co-ordination, reporting and finance. NAST hosted the Project Office in Nepal, managed contracted staff, and provided leadership in bioenergy research and development, especially biochar technologies. NAST was responsible for liaison with the relevant Government Ministries. The Chief of the Faculty of Science, Mrs Jaishree Sijapati, co-led the project. Dr Ekananda Poudel was recruited as the Project Officer. NAST senior scientists Dr Shandesh Bhattarai (Botanist) and Dr Rabindra Dhakal (Bioenergy expert) worked as a part of the team.

2. Department of Plant Resources (DPR), Ministry of Forests and Environment (MoFE)*
www.dpr.gov.np
DPR is the national authority for plants and CITES. Established in 1964, DPR has an active programme of taxonomic and applied research, manages the National Herbarium (KATH) and the National Botanical Garden, and is a main partner on the Flora of Nepal. DPR provided leadership in biodiversity research and documentation (DPR is Nepal's leading botanical authority), and restoration of degraded lands, especially in relation to AIPS and NTFPs. DPR was responsible for liaison with Department of Forests, Department of National Parks and Wildlife Conservation, and other staff in MoFE (especially CITES and CBD Focal Points). DPR provided hot-desk facilities at KATH, and facilitated access to the herbarium,

library and living collections. The Director General at DPR, Dr Sanjeev Rai, co-led the project.
*Previously Ministry of Forest and Soil Conservation (MoFSC)

3. Tribhuvan University, Central Department of Botany (TU-CDB)
www.cdbtu.edu.np
Botany has been taught at TU-CDB since 1947 and it is responsible for all academic programs of Botany within TU. It runs a postgraduate programme (MSc and PhD). TU-CDB has trained over 2000 M.Sc. (Botany) students since 1965. It maintains an active research programme and is a centre of excellence for research on invasive plants, and sustainable development programmes, especially those relating to NTFPs. Three MSc students worked on the alien floras of three target Districts. The Head of Department, Prof. Mohan Siwakoti, co-led the project. Assistant Professor Dr Bharat Babu Shrestha (Invasion Biology expert) led the TU-CDB component of the project and supervised the MSc students.

4. HELVETAS Swiss Intercooperation, Nepal Office
nepal.helvetas.org
HELVETAS came to Nepal in 1956 and cooperates with many technical and social organizations in all Districts. HELVETAS aims to create an environment where people have new choices and become equipped with new skills and abilities to improve their livelihoods. It promotes the principles of decentralization and subsidiarity in decision-making, implementation and accountability for development. Environment and Climate is one of the organisation's working areas, and HELVETAS runs the EU-funded bioenergy project (http://bioenergy.org.np), up-scaling the production and consumption of bioenergy to reduce carbon emissions and enhance local employment in Nepal. Country Director Dr Bharat Pokharel co-led the project.

5. ForestAction
www.forestaction.org
ForestAction (Forest Resource Studies and Action Team), established in 2000, is a Nepal-based NGO which focuses on research, policy dialogue and stakeholder engagement to achieve productive, sustainable and equitable forest management. ForestAction was the main implementing partner for all field/community-based activities and socio-economic surveys. Dr Birendra Karna (Co-ordinator) and Dr Lila Nath Sharma (Project Officer) were the primary ForestAction staff involved in the project.

6. University of Tasmania (UTAS)
https://www.utas.edu.au/technology-environments-design/geography-and-spatial-sciences
UTAS supported the project by undertaking the GIS Remote Sensing (RS) of invasive species and by developing a RS algorithm to monitor the distribution and spread of several invasive species in Nepal. Senior lecturer in Geography and Spatial Sciences, RS expert, and Nepalese national, Dr Jagannath Aryal undertook this research.

During the project all team members were in regular contact via Skype, email and Facebook messenger. Mobile and landline phone calls are the primary means of communication at field sites as mobile internet connections are unreliable. The Project Officer at RBGE was in regular contact with Project Officers at NAST and ForestAction, and regular Skype meeting were held between Project Officers and key personnel throughout the time of the project. Key project people in Nepal communicated by phone and face-to-face meetings.

A Project Management Committee, which included members from all partner institutions, oversaw project activities. The close, effective partnership was strengthened during Y1, and underpinned the success of the project. This excellent partnership also resulted in a successful grant application to GBIF's Biodiversity Information Fund for Asia (BIFA), led by TU-CDB, to mobilize historic occurrence data of the Invasive Alien Species (IAS) of Nepal. The BIFA project was successfully completed in June 2019 (https://www.gbif.org/event/3heXnXGJGPRyacMxDiuXye/result-sharing-meeting-of-bifa-project-mobilizing-occurrence-data-of-alien-and-endemic-plant-species-of-nepal).

Similarly, using the experience gained from being a project partner, and with additional mentoring from RBGE, ForestAction successfully applied to the Darwin Initiative as Project Lead to develop forest management in Nepal (Project ref no: 26-022: Uprating community forest management in Nepal: enhancing biodiversity and livelihoods).

The RBGE Project Officer visited Nepal in April 2019 to work with in-country partners to prepare this final report. All project partners were involved in the writing of this report and the supporting documentation.

3 Project Achievements

3.1 Outputs

Output 1. Capacity for managing and controlling invasive plants built, practical control methods employed, and restoration of land degraded by invasive plants into economically and environmentally beneficial habitats initiated in 15 CFUGS.

614 people (more than 50% women) received direct extensive training on the management and control of AIPS of Nepal during nine major workshops for 15 CFUGs in three districts (workshop reports: (Supplementary Documents [Sup. Doc.] 3-11, photos: https://www.flickr.com/photos/152233654@N02/albums/with/72157706840285781)

More than 700 people participated in the awareness program on the impact of AIPS and best management practices to control AIPS in their Community Forest and private land (Sup. Doc. 27-29). Altogether around 3100 (1500 in Y2, 1600 in Y3) households were actively involved in bush clearing in invaded lands, contributing approximately 5700 person-days of work. During the project AIPS were removed from total of around 481 hectares (80 in Y1; 156 in Y2; 245 in Y3) of land, and the reclaimed land was restored with the planting of around 31,000 seedlings of native and economically useful plant species (Sup. Doc. 32).

CFUGs are now managing regrowth and encroachment of AIPS in their Community Forests and are producing char and biochar. Annual programmes to remove of AIPS, monitor regrowth, and utilize cut biomass for char and biochar production, have been incorporated into Community Forest Management Plans. Three CFUGs Management Plans have already been updated (Sup. Doc. 32), and others have pledged to update them when they next revise their Operational Plans.

A Nepali language brochure was produced in Y1 (Sup. Doc. 2) to raise awareness of AIPS of Nepal, and a journal article (Sup. Doc. 17) in Nepali was published discussing the management of invasive species and to raise awareness on different level from local community to government.

A poster covering 26 of the most problematic AIPS of Nepal (Sup. Doc.12) was printed. It was first of its kind ever produced in Nepal. 1000 copies have been distributed all over Nepal, and it has become very popular as a teaching resource and to help local people identify AIPS of Nepal.

Output 2. Weed species researched and evaluated and local community understanding of invasive plants enhanced. A national list of priority invasive plants established, supported by a bilingual identification manual and the raising of public awareness.

Three MSc students have successfully completed their MSc theses on inventories of weed species and naturalized alien species across different land use types in three districts (Sup. Doc. 18-20). All three were awarded the highest grade, Grade A. A total of 2141 accurately identified, data-rich herbarium specimens were collected and deposited at Tribhuvan University Central Herbarium (TUCH). The MSc students visited the National Herbarium of India (CAL) in Kolkata for training and to identify the specimens collected during their field trips (Sup. Doc. 26, page 8; Sup. Doc. 23).

59 TU Botany MSc students were trained in fieldwork techniques, plant collecting and plant identification (TU-CDB report Sup. Doc. 24; photos in flickr: https://www.flickr.com/photos/152233654@N02/albums/72157684168807805).

A customized high-speed herbarium specimen digitization unit was installed at the National Herbarium of Nepal (KATH), and this has almost tripled the rate of specimen digitization (Sup. Doc. 36, https://biss.pensoft.net/article/37095/). Building on the partnership from the Darwin project, TU-CDB in collaboration with RBGE and DPR secured additional funding from GBIF-BIFA for the digitization of herbarium specimens of alien plant species deposited at TUCH and KATH herbarium. Altogether 5266 occurrence records of alien species in Nepal and their geo-located data are now available freely via the GBIF website (https://www.gbif.org/project/3IvP2nISis66g6ceka6C8e/mobilizing-occurrence-data-of-alien-and-endemic-plant-species-of-nepal#datasets).

A national list of 26 AIPS was compiled in consultation by project partners with other botanical experts in Nepal. A workshop applying new IUCN guidelines on assessing invasive plant species was held, and these species were prioritized for conservation action based on their observed and perceived impacts (Sup. Doc. 16). The results of these activities were shared with the Government of Nepal and have been included in Nepal's 6th National Report to CBD (Sup. Doc. 22, page 66).

A bilingual identification manual of 26 AIPS was published (Sup. Doc 39) and tested with local communities. This knowledge-product is freely available on the project web site as a series of species monographs (http://www.invasiveplantsnepal.org/invasive-plants/). These species pages have been compiled into a manual that is due to be printed in October 2019).

Articles on invasive species and the activities of the project have been published in popular mainstream media in Nepal (Kanitpur, Annapurna and Nagrik) and also in online news portals (Sup. Doc. 10). A research article on climatic niche modelling covering 24 species of invasive plants was published, incorporating data from several linked projects and the current Darwin project (Sup. Doc. 30; https://onlinelibrary.wiley.com/doi/epdf/10.1111/ddi.12963). Remote sensing mapping of *Chromolaena odorata,* one of the most problematic species, was completed (Sup. Doc. 42) and the manuscript is being finalized for publication.

Output 3. Charcoal production facilities successfully introduced, and communities are linked up with market facilities. Small-scale women-run co-operatives derive alternative incomes from char. Improved Cooking Stoves (ICS) successfully installed and contributing to reduced use of wood and enhanced wellbeing of household members.

Local communities from 15 CFUGs received theoretical and practical training on the production of char (Sup. Doc. 3-8). CFUGs at Makwanpur and Nawalparasi districts were given training and linked with distribution networks, enabling the sale of char and income generation. The CFUGs in Bardiya were more interested in the production of biochar, due to the absence of a market for char.

More than 40 women from marginalized and disadvantaged communities were involved in char production and generated the income of over NRS 600,000 (£4,400) (Sup. Doc. 32). Two new women's groups were constituted in Makwanpur district, and they continue to be actively involved char production and sale. They are using income generated from the sale of char to fund additional income generation activities such as vegetable farming and goat rearing (Sup. Doc. 34).

34 people (out of which 26 are women) received extensive practical training on the manufacture and installation of Improved Cooking Stoves (ICS). These stoves are not only energy efficient but also produce no smoke in the kitchen, thereby reducing the harm caused by smoke inhalation. ICS also enable woody biomass from invasive plants to be used as fuel. ICS were distributed to 351 households, and more than 60% of them had already adopted ICS as their primary cooking stove. More than 2,000 people have benefited from ICS (Sup. Doc.13-15). The use of ICS has reduced firewood consumption by 60%, and saved cooking time by 50% (Sup. Doc. 40). Respondents have reported an improvement in their living conditions due to the reduction in smoke in their kitchens.

Output 4. Biochar technologies successfully introduced, biochar manufactured locally and used to improve soil fertility of degraded land and to sequester carbon. Compost plants established to produce compost from invasive species.

More than 700 households participated in training on the theory and practice of biochar production (Sup. Doc.3-11; 28, 29, 37; photos: https://www.flickr.com/photos/152233654@N02/albums/with/72157667567014307).

Local biochar production facilities have been established in each of the three focal districts, and the communities provided with equipment and resources to produce biochar. Demonstration cultivation plots have been established in each district to show the positive effects on crops. The results from the first two demonstration plots were not satisfactory, but the lessons learned from their creation helped to improve methods, and subsequent plot in Bardiya produced excellent results.

More than 25 metric tons of biochar has been produced, and the CFUG members have pledged that they will continue to produce biochar from AIPS and other waste products available in CF and private lands. These activities have been incorporated into CF management plans. Biochar Committees have been formed in each district to promote biochar, and they have been active in encouraging and supporting local communities to produce biochar (Sup. Doc. 37).

It has proved difficult to accurately quantify biochar production, and we estimate that we are slightly below our target of 45 metric tons. However, as the communities have already seen the long-term benefit of the biochar application to soil fertility, they have said that they will continue to produce biochar to use in their farmlands.

MSc student Pratibha Paudel successfully completed her MSc thesis on the effect of biochar in soil improvement, and its role on carbon sequestration (Sup. Doc. 21). Her results show the significant

improvement on soil quality ($p<0.05$, increased potassium and carbon) after the application of biochar made from *Chromolaena odorata*, and crop yield increases of 16%. A survey of households shows reported increases of 30% in the production of chilli peppers, and ca. 15% in other crops (Sup. Doc. 40). Based on this MSc research project, it has been estimated that at least 18 metric tons of carbon has been sequestered in the soil through the incorporation of 25 metric tons of biochar during the project.

3.2 Outcome

The project team considers that this ambitious project achieved the intended Outcome. In some areas we were able to go beyond and extend the stated Outcome, and in a few areas we were slightly below in terms of the Measurable Indicators set when the project was formulated. We were delighted with the high level of dedication and engagement from the local communities. They were highly motivated as they recognise the dramatic negative effects that invasive plants have had on their forests and fields, and the opportunities that the project offered. More than 2,000 households (ca. 6,000 people) from 15 CFUGs actively participated in training events, awareness programs, bush clearing, habitat restoration and production of char and biochar (Sup. Doc 3-11, 27-29, 32, 37; photos: https://www.flickr.com/photos/152233654@N02/albums/with/72157667567014307).

Knowledge generation, knowledge transfer, and the application of science-based approaches was at the heart of this project. The knowledge gap in the understanding of weed species, which are usually under-recorded in biodiversity studies, was addressed by a wide-ranging inventory study led by TU-CDB. As part of this, three MSc students completed their Master theses on the weeds and naturalized plant species found in different land use types in three districts (Sup. Doc. 18-20). 2,141 data rich, accurately identified herbarium specimens were collected and submitted to Tribhuvan University Central Herbarium (TUCH). These, and other experimental and observational data, were used to characterise the most problematic AIPS in Nepal using the IUCN Invasion Threat Assessments, produce knowledge products, and as a basis for the spatial analyses.

Awareness of the problems of AIPS and the opportunities for biochar was raised locally and nationally through TV interviews, media articles, printed publications and the project website. A Nepali-language brochure was produced (Sup. Doc. 2), and an article was published in “Hamro Ban Sampada” vol. 14 (1): https://www.forestaction.org/publications/view/251. A much-praised poster illustrating the 26 nationally most problematic invasive species was produced and distributed widely to community groups across Nepal (Sup. Doc.12). A bilingual (English and Nepali) manual of the 26 most problematic AIPS of Nepal was published and tested with local communities (Sup. Doc. 39). Local people are now capable of identifying the invasive species that grow in their forests and surrounding land, enabling targeted action to control established invasive plants and to stop new invasions. This, combined with land restoration plantings, is actively promoting the recovery of native biodiversity in these cleared areas, and the identification of newly arrived problematic plants and their prompt removal, is **safeguarding biodiversity** (Sup. Doc. 37).

There were major improvements in the control and **effective management** of invasive plants in Community Forests. Around 481 ha of invasive species-dominated areas, 41% of the total recorded in the project sites, were cleared of invasive plants and **biodiversity restored** with the planting of around 31,000 saplings/seedlings of 20 different species of economically important useful native plants (Sup. Doc. 32, 33). The techniques and methodologies have been incorporated into formal CF Management Plans and Operational Plans, which are approved by government through District Forest Offices.

The use of biomass of removed invasive plants, supplemented by other waste biomass, as a **climate smart source of bioenergy** was achieved through the installation of 351 improved cooking stoves (ICS) and the production of char/biochar. ICS were distributed to 351 households in 3 districts, providing a smoke-free cooking alternative to the traditional hearths. This enables the direct use of invasive plant woody biomass as a fuel, and also reduces fuelwood demand as ICS are more efficient. Households who have adopted ICS as their main cooking stove reported a 60% reduction in their use of wood and a 50% saving in time spent cooking (Sup. Doc. 40). More than 1,000 people, mostly women and children, are benefitting from these stoves, and smoke free kitchens. They report that this has significantly enhanced their living conditions, and **improved their health and wellbeing**. There is now great interest from surrounding communities who have seen these benefits and wish to adopt these technologies.

The production and use of biochar was also successful, although the ambitious targets set at the start of the project were not fully met (discussed later). Although these are unfamiliar technologies for rural communities, they immediately recognised their usefulness and they were quick to learn the theories and practical applications shown in the training programmes. Local people were further convinced of these approaches when they saw improved crop yields in the demonstration plots from the use of activated

biochar for **soil improvement.** The benefits of the application of biochar were clear to them, and measurements from the demonstration plots showed that crop yield increased by an average of 20%, with the highest yield increase of 30% seen in chilli pepper production (Sup. Doc. 40). In two of the three study areas there was a local market for char, and three women's groups (two of which were newly constituted) produced more than 60 tons of char and derived an income of NRS 600,000 (£4,400) (Sup. Doc. 34). The women's groups are now using this new source of income to support new initiatives in vegetable farming and goat rearing, which are extending the **livelihood benefits** of the project. 15 CFUGs are now producing biochar from AIPS and other forest/domestic waste products. This has had global benefits as we estimate that at least 18 metric tons of carbon was sequestrated through the production of 25 metric tons of biochar and its incorporation into the soil.

3.3 Impact: achievement of positive impact on biodiversity and poverty alleviation

Although the full Impact Statement of the project will be achieved in the years ahead, the activities of the project have already shown some direct positive impacts on biodiversity and poverty alleviation. 481 ha of Community Forest have now been cleared of invasive species and restored by the planting of more than 31,000 saplings/seedlings of 20 economically useful native species (Sup. Doc. 32, 40). These have set the basis for natural regeneration of the native flora, with regular monitoring and control as set out in new CCF Management Plans to keep out AIPS. Biodiversity is already benefitting, and CFUGs will get direct economic benefit from these trees in few years' time when they start cropping. There have been several other aspects of the project which have contributed to poverty alleviation. Disadvantaged and marginalised poor people have made extra income of NRS 600,000 by selling char made from waste biomass (Sup. Doc. 34, 40), and they have been using some of the income to fund the establishment of new income generation enterprises such as vegetable farming and goat rearing of. More than 200 rural household are now benefitting from smoke free kitchens through the use of energy efficient Improved Cooking Stoves. These stoves have reduced the firewood consumption in these households by 60%, thereby reducing the pressure on local forest resources. Women have reported a 50% saving in time spent cooking, and incidences of smoke-related illness have been reduced (Sup. Doc. 40). Local people have benefitted by increases in crop yield (20% in average) through the use of activated biochar as a soil improver (Sup. Doc. 40). At least 18 metric tons of carbon has been sequestered in the soil through the use of 25 metric tons of biochar produced during the project as a soil improver. The level of participation by women has been very encouraging, with the gender balance being at least 50:50. Local women's groups have been encouraged to participate in the project, and have become confident to be involved in project activities, and the management of Community Forests and other community resources.

4 Contribution to Darwin Initiative Programme Objectives

4.1 Contribution to Global Goals for Sustainable Development (SDGs)

SDG 1 No poverty: Rural poor groups are deriving extra income from selling char. They made additional income of NRS 600,000, some of which has been invested in further income generating activities. Crop yields have increased through use of biochar as a soil improver, enabling some production to be sold in markets. In the long term, the plantation of economically useful plants in reclaimed land will further contribute towards poverty alleviation.

SDG 3 Good Health and Well-Being for people: Installation of Improved Cooked Stoves (ICS). 351 ICS were distributed to replace traditional stoves in rural areas to provide smoke free cooking in rural households. This has already produced significant health and well being improvements for women and children. Local people are capable to identify potentially harmful species such as *Parthenium hysterophorus* (confusable with an important medicinal plant), *Argemone mexicana* (a poisonous weed and seed contaminant of mustard crops), which have direct health impacts if handled improperly.

SDG 5 Gender Equality: Involvement of women in the project – women's groups and individuals have participated actively in the project, with at least 50:50 gender balance.

SDG10 Reduced inequalities: Involvement of disadvantage and marginalised groups. We are working in some of the poorest areas of Nepal, with some marginalised and disadvantaged group (e.g. Dalits).

SDG 13 Climate action: At least 18 metric tons of carbon were sequestrated through the incorporation of approximately 25 metric tons of biochar as a soil improver. The project has raised awareness of the effect of climate change on the increasing spread of AIPS in Nepal, and helped to mitigate this by increasing knowledge of how to identify and control invasive plants.

SDG15 Life on land: Management of Invasive species. CFUGs have been trained in the management of invasive species, and their Management Plans and Operational Plans updated to included these practices. 481 ha of lands infested by AIPS were cleared, and restored by the planting of 31,000 seedlings of economically useful native plants.

SDG17 Partnership: Partnerships between local organisations, government, and NGOs have been created and enhanced, bringing together diverse expert groups to tackle the problem of AIPS and the negative effect they have on biodiversity and local people.

4.2 Project support to the Conventions or Treaties (CBD, CITES, Nagoya Protocol, ITPGRFA)

This project directly supports the CBD. A significant indicator of this is the inclusion of project outputs and policy advice in Nepal's 6th National Report to the Convention on Biological Diversity (Sup. Doc. 22, page 66 &114).

Art 7 – capacity to identify and monitor AIPS has been enhanced during workshops, and university staff and students have been actively engaged in collecting, recording and identifying AIPS in the project areas. This will also inform the conservation measures needed and strategies for sustainable use. [Aichi Target 9]

Art 8 – local community groups now understand the importance of biodiversity and threats from AIPS, and have agreed to revise their management plans to consider biodiversity (including AIPS and habitat restoration) and the use of AIPS to improve livelihoods. [Aichi Target 2, 5 & 7]

Art 10 – government and private sector project partners working together to raise awareness and empower local people (through workshops and follow on activities) to conserve biodiversity and use it sustainably. [Aichi Target 1]

Art 12 – capacity has been built, both within project partners and with participants on the project, through working together and sharing experiences in workshops and other project activities. This has included international collaborations to address real issues with invasive plants in Nepal [Aichi Target 19].

4.3 Project support to poverty alleviation

A major component of the project directly addresses poverty alleviation, and the local communities we are working with are from very poor areas of Nepal. Local and disadvantaged (Dalit) women have already made an extra income of NRS 600,000 from the production and sale of char. These women's group are actively involved in additional income generation activities, such as vegetable farming and goat rearing, using seed money saved from char production and support from the project (see above Output 3). Local people in all 15 CFUGs have been trained in making char and biochar and provided with equipment. The incorporation of biochar in cultivated land reduces the use of chemical fertilizers, which has health, economic and environmental benefits. For the first time, local women in Bardiya are now benefitting from smoke free cooking environments, which not only diminishes respiratory diseases caused by smoke inhalation, but also reduces firewood consumption and time spent cooking. 351 improved cooking stoves were distributed to replace traditional stoves (see above Output 3). Trained women are able to derive additional income through cash or reciprocal provision of labour by manufacture and installation of these stoves for others. Altogether 31,000 seedlings of economically important species were planted on restored land. Local people will directly benefit from the products of these useful tree species in the future.

4.4 Gender equality

The lead partner organisations and implementing partners all have gender equality as a core value, and have actively encouraged women to be involved in the project. This mirrors the GoN's focus on reducing gender inequality. Project activities were arranged so that they facilitated the participation by women. We recognised that many women have commitments to their families and so, wherever possible, we timetabled activities to minimise conflicts with these commitments. Two of the CFUGs selected for project interventions are led by a women-only team (Mahila Majhari and Mahila Jagriti, Sup. Doc. 1). The participation of women in all workshops was high, at over 50% (Sup. Doc. 3-11). More than 30 women from disadvantaged (Dalit) and the highly marginalized Chepang communities were involved in char production and making extra income from selling char and reinvesting funds (Sup. Doc. 34). 26 women were trained in the installation of Improved Cooking Stoves. In addition, we contracted local women's groups to help with logistical arrangements (e.g. providing catering), which promotes inclusion in project

activities and increases the income of these groups rather than individuals. Three of the four MSc students supported and trained within the project are women.

4.5 Programme indicators

- **Did the project lead to greater representation of local poor people in management structures of biodiversity?**

We worked mainly with local poor people including marginalized and disadvantaged groups. More than 50% of local people have a clear understanding of AIPS and they are now capable of identifying the dominant invasive plant species in their forests (Sup. Doc. 40). More than 3,000 households are involved on the clearing on invasive species from their forests (see Output 1). These grassroots capacity building activities have increased their involvement in CF management and the effectiveness of the CFUG user groups. As Nepal transitions to a decentralised, federal system, more responsibility will be placed on these local groups and so this project has empowered local poor people to engage in these biodiversity management structures.

- **Were any management plans for biodiversity developed and were these formally accepted?**

Forest Management and Operational Plans in 3 CFs have already been updated and formally approved. These now include yearly removal of AIPS from the Community Forests and utilization of the biomass for char and biochar production. Other CFs have pledged to include AIPS management in their Operational and Management Plans when they next renew these documents.

- **Were they participatory in nature or were they 'top-down'? How well represented are the local poor including women, in any proposed management structures?**

Updates to Management Plans were made by the CFUGs themselves following training, knowledge building, and practical experience derived from participation on the project. Having seen the positive effects of the actions and activities they proposed changes to their Management Plans; hence the time lag in having the Management Plans updated and formally approved by District Forest Offices. The project team supported the updating of the plans, but the drive came from the local people. Two of the CFUGs selected for project interventions are led by a women-only teams (Mahila Majhari and Mahila Jagriti) and they now fully understand the importance and need of proper and timely management of AIPS in their forests.

- **How did the project positively influence household (HH) income and how many HHs saw an increase?**

40 households directly benefited by selling of char. 50 households in Bardiya applied biochar to their crops and yields were increased by 20%. Other activities such as plantation of economically useful plants and installation of ICS will help to improve the livelihoods of more households in the longer term.

- **How much did their HH income increase (e.g. x% above baseline, x% above national average)? How was this measured?**

40 households from marginalized poor communities directly benefited by selling char. The average household income of these households increased by around 25%.

4.6 Transfer of knowledge

The generation and transfer of knowledge lies at the core of this project. The project resulted in four high grade post-graduate (MSc) qualifications in Nepal by supporting their MSc thesis study; three of the students are female (see Output 2 & 4). Knowledge generated from these studies, along with a survey of the literature, use of existing Flora of Nepal data, mobilisation of knowledge from historic herbarium specimen, and contributions from botanical experts were used in the preparation of a series of knowledge products (discussed in Annex 2), the AIPS assessment workshop, the training events, policy briefs and scientific studies.

Three journal articles have been published or are in press. A bilingual manual of the 26 most problematic AIPS of Nepal was produced with input from local communities and made available on the project website. This will be published as a 'Plants and You' printed book in October 2019 and distributed

amongst the project participants, and CFUGs. The poster on invasive plants proved to be very effective in raising awareness and to direct users to the more detailed information available on the project website.

The impact assessment workshop highlighted the growing threat from AIPS in Nepal among biodiversity scientists, GoN officials, policy makers and conservationists. Policy advice resulting from this has been incorporated in Nepal's 6th National Report to CBD, noting that some of our activities have directly contributed to Nepal achieving global Aichi Biodiversity Targets. Project partners shared this knowledge with CFUGs and District Forest Officers for the updates to the CF Management Plans. MSc students and project partners presented the project activities and outputs at international and national conferences (Annex 3, 14a).

4.7 Capacity building

Dr Lila Nath Sharma (male), Project Officer at ForestAction has been promoted to the role of Project Manager of the new DI project on Jalthal forest in East Nepal, and is responsible for overall management of that project. Dr Sharma, and colleagues in ForestAction developed the concept for this project using their experience on our DI project, and received additional mentoring from RBGE to prepare the successful application. ForestAction is the lead on the new project, with RBGE a partner.

Dr Bhaskar Adhikari (male), Nepalese Project Officer at RBGE, has been recently appointed to the full time, permanent post of Temperate Asia Taxonomist at RBGE. The project management, people management, and financial management skills Dr Adhikari developed during the project were a contributing factor to his appointment. Dr Adhikari continues his work on Nepalese biodiversity, part of which is coordinating the RBGE's component of the new Darwin project led by ForestAction.

Dr Bharat Babu Shrestha (male), project co-ordinator at TU-CDB, has been recently selected as IPBES fellow for the assessment of invasive alien species.

Three MSc students (2 females, 1 male) started teaching at private colleges in Kathmandu.

5 Sustainability and Legacy

We have been pleased to see growing awareness and understanding on the impact of invasive plants in Nepal at the local and national level, and interest in the approaches taken by the project. There has been excellent engagement in project activities at all levels, as is shown in the reports. Project partners have developed good links with media in Nepal, resulting in well-written, informative articles in major Nepalese newspapers. The project has a website and social media channels where we promote the project and make images, data and reports freely available.

We have already made strides to sustain a legacy through additional activities which build on or extend those funded by the DI. TU-CDB successfully initiated and completed a GBIF-BIFA project to digitize distribution data on existing herbarium specimens of invasive plants. ForestAction has funded the installation of composting facilities and training their use in response to requests from local communities in the project area. ForestAction has also successfully applied for funding from DI round 25 (26-022) to work on Community Forest management in eastern Nepal. One of the outputs of the project is to manage *Mikania micrantha*, Nepal's most problematic invasive weed, in Jalthal forest. These are examples where in-country partners are continuing and developing the work undertaken in the project, thereby sustaining the legacy. All project partners continue to work on invasive plants and other aspects of biodiversity conservation in Nepal, both independently and collaboratively – the partnership will endure. Connections with local communities involved in the project also continue and project partners will continue to offer support whenever possible.

The utilization of biomass of invasive species in the production of char and biochar, and regular clearing of invasive species from Community Forest, is now incorporated in CF Management and Operational Plans, and so will be sustained. The project activities directly contributed to the National level commitment to achieve the global Aichi Biodiversity Targets, especially Target 9, and the project achievement is included in Nepal's 6th National Report to CBD (see Output 2: https://chm.cbd.int/database/record?documentID=241425; doc. 22).

Of the project-funded contract staff at partner organisations: Dr Lila Nath Sharma (ForestAction) has started a new role at ForestAction as Project Manager for new DI project (26-022); Dr Bhaskar Adhikari (RBGE) has been appointed onto the permanent staff at RBGE (for both see 4.7), and Ekandana Poudel (NAST) has joined ForestAction on a short-term contract. Equipment supplied to CFUGs and local community groups for the manufacture of char remains with these groups. Herbarium digitisation equipment (part funded by the project) has been donated to the National Herbarium where it has

significantly enhanced the digitisation programme providing digital access to specimens for biodiversity studies. Small items, such as fieldwork equipment, remain with project partners in Nepal to be used by their staff.

6 Lessons learned

Managing the expectations of partners and local communities is often challenging, and this was made more difficult by budget difficulties in Y1 and Y2 caused by exchange rate changes caused by the decline in the value of sterling following the Brexit referendum. This resulted in a loss of ca. 10% of the budget available in Nepal. All project partners were aware of this at the start of Y1, and consequently modified their activities throughout the project.

A cost benefit analysis of bio-briquettes showed that the production of briquettes at the local scale was not cost effective. After discussion with communities and partners, it was decided to seek additional external funding to install a pelletizer. However, the cost of a pelletizer turned out to be much higher than expected, and we had to alter our plans. Instead of briquettes, project partners decided to redirect this activity to the installation of Improved Cooking Stoves, and these were incorporated into the project activities. This has proved highly successful. Development opportunities evolve rapidly, and it is important for project partners to be flexible, monitoring planned activities and changing them if better alternatives become available.

The Project Management Committee provided a forum to discuss lessons learned and rapidly incorporate them into ongoing activities. The project team realised that it is difficult to manage resources at multiple sites where the sites are far from each other. We also realised the need for a local Project Office at each site and at least one full-time member of staff on the ground for effective management of project activities and regular monitoring. These lessons have been incorporated into the design of the new project led by ForestAction which is working at sites within a smaller area and has established a local Project Office and local staff.

6.1 Monitoring and evaluation

As the project evolved we needed to make some changes (approved through change requests) to the Logframe in Output 3, mainly with respect to replacing bio-briquette manufacture with Improved Cooking Stoves (ICS). The need for this change was flagged up in Yr1 and Yr2 reports, and we acted on the recommendations of the External Reviewer on installation of ICS. Our M & E system was helpful, and the cost-benefit analysis, based on feedback from local CFUGs (submitted with Y2 report), showed that the small scale production of bio-briquettes was not cost effective. This was because the money made by CFUGs in selling the raw material char directly to market was more than the profit from the sale of bio-briquettes once the cost of densification was factored in.

The overall progress of the project was monitored and evaluated regularly by Team Leader Dr Mark Watson and RBGE project officer (Bhaskar Adhikari). Within Nepal, TU-CDB formed their own internal Project Management Committee to monitor the progress of activities assigned to them. NAST formed an over-arching national Project Management Committee which met every 3 months, sometimes more frequently if needed. Following Y1 review comment, a full Project Management Committee was formed including 10 members representing all partner institutions. Part-time M & E consultant Dr Bhima Dhungana internally assessed project activities and advised accordingly, and was very helpful. The success or otherwise of each activity was monitored at its conclusion, with lessons learned fed back into later activities. Financial monitoring and accounting at RBGE was provided by the RBGE Finance Officer, and this was mirrored at NAST for in-country spend.

6.2 Actions taken in response to annual report reviews

We received very helpful feedback from reviewers of Y1 and Y2 annual reports. We responded fully to their recommendations, incorporating them into project activities. Following Y1 reviewer comments, we undertook the cost-benefit analysis on the production bio-briquettes, and submitted this with Y2 report. Likewise we produced AIPS posters which are now displayed in government offices, universities and CFUGs offices. Installation of improved cooking stoves in rural communities was also recommended and proved to be very successful with a larger than expected impact on the health of women and children. Project Management Committee was established in Y2 as per reviewers' comments. An internal Mid-Term Review report was undertaken and submitted as a supplementary document (Sup. Doc. 41) with

this report. Local women's cooperatives, with help from project staff, drafted business plans for using funds generated by selling char for boosting livelihood activities.

7 Darwin identity

This is a stand-alone project with clear identity, with major funding from the DI. This is recognised in all aspects of the project, and the role of the UK Government in supporting the DI was clearly made. Acknowledgement of DI funding was included in journal articles, reports, media interviews and other publications. The DI logo was used in all workshops banners, printed materials, and project website (see attached supporting documents). A logo sticker has been produced to label all the equipment bought with DI funds. The Government of Nepal and other organizations are very familiar with Darwin Initiative from several high-profile DI funded projects in Nepal, and the support of the UK Government, through the Darwin Initiative, is widely understood and appreciated. The Team Leader Dr Mark Watson also gave a presentation on during the midterm review in January 2018 to highlight Darwin Initiative funding (Sup. Doc.41), and also co-organised and spoke at a Darwin Initiative session at the 6th Global Botanic Gardens Conference in Geneva. Twitter, Facebook and Flickr accounts have been set up, and linked with the project website. Because of limited access to the internet, particularly at project sites, the in-country use of social media was not as high as expected.

8 Finance and administration

If all receipts have not yet been received, please provide indicative figures and clearly mark them as Draft. The Actual claim form will be taken as the final accounting for funds.

8.1 Project expenditure

Project spend (indicative) since last annual report	2018/19 Grant (£)	2018/19 Total actual Darwin Costs (£)	Variance %	Comments (please explain significant variances)
Staff costs (see below)			0	
Consultancy costs			0	
Overhead Costs			2	Fluctuation of foreign exchange rates (partners overheads)
Travel and subsistence			4	Due to increase of cost of air tickets
Operating Costs			6	Costs of workshops lower than expected
Capital items (see below)			20	Cost saving. Items less expensive than anticipated
Monitoring and Evaluation			5	Fluctuation of foreign exchange rates
Others (see below)			10	
TOTAL				

Staff employed (Name and position)	Cost (£)
Dr Birendra Karna (Part time Team leader)	
Dr Lila Nath Sharma (Project officer)	
Dr Ekananda Paudel (Project officer)	
Tej Bahadur Tharu (Part time field assistants)	

Ram Prasad Pathak (Part time field assistants)	
Laxman Paudel (Part time field assistants)	
Dr Bhaskar Adhikari, Nepalese Project Officer (RBGE)	

Capital items – description	Capital items – cost (£)
Capture One Software for KATH herbarium, Nepal AC powered ring flash for KATH herbarium, Nepal Colour charts for KATH herbarium, Nepal Camera lens	
TOTAL	

Other items – description	Other items – cost (£)
Consumables ForestAction Consumables NAST Printing manuals Broadband Medical insurance Stationary Books Software Lens cleaner	
TOTAL	

8.2 Additional funds or in-kind contributions secured

Source of funding for project lifetime	Total (£)
Support from Forest Department for Nursery	
Support from ForestAction Nepal for composting plant	
RBGE expedition fund to Bhaskar Adhikari for field work	
RBGE fund to buy high resolution image data for remote sensing	
Helvetas in-kind support using their network from bio energy project	
In kind salary cost of Nepal partner organizations	
In-kind salary cost of RBGE staff	
In-kind Forest department nursery materials	
In-kind University of Tasmania staff time for remote sensing	
TOTAL	

Source of funding for additional work after project lifetime	Total (£)

TOTAL	

8.3 Value for Money

RBGE has over 20 years experience of working in Nepal, and has collaborated with DI partners on previous projects. This experience and the excellent working relationships enabled the setting of an accurate budget at the proposal stage, and realistic expectations of what would be achieved and at what cost. UK salary costs covered only the salary of the contracted Nepalese Project Officer based at RBGE, with other RBGE salary costs and associated overhead costs provided in-kind. Project partners in Nepal also provided significant in-kind support of salary and overhead costs.

Within Nepal spend was monitored and controlled by NAST using their internal financial and procurement systems, and overall spend was monitored and evaluated by RBGE with its financial systems and audits. All spend had to be receipted, or otherwise accounted for, with full reconciliations. RBGE's organisational procurement requirements were followed, balancing quality with cost. Project partners are confident that all project expenditure has been effective, efficient and transparent.

The 10% drop in exchange rate at the start of the project posed significant challenges to partners in Nepal and the planned activities. Partners rose to the challenge, securing discounts and additional funding to continue the original plans, only reducing the scope of the work when absolutely necessary. This has resulted in exceptional value for money. The exchange rate changes were carefully monitored throughout the project and adjustments to work plans made as necessary.

RBGE undertook an active budget management approach to ensure all parts of the project were in balance. The project team in the UK regularly reviewed the financial situation to identify any significant divergences in spend and took corrective action. Budgets were a standing discussion item in the wider Project Management Committee.

Significant in-kind support and additional funds were secured from partner organisations, local government and communities. Additional funding was found to extend the impact of the project, notably with the GIF-funded BIFA digitisation project.

Annex 1 Project's original (or most recently approved) logframe, including indicators, means of verification and assumptions.

Note: Insert your full logframe. If your logframe was changed since your Stage 2 application and was approved by a Change Request the newest approved version should be inserted here, otherwise insert the Stage 2 logframe.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Impact: Reduction and ultimate eradication of invasive plants in forests, farmland and wild habitats in Nepal: improving biosecurity, safeguarding globally significant biodiversity, and improving livelihoods and wellbeing of natural resource-dependent people.			
Outcome: Increased knowledge, awareness and effective management of invasive plants in Nepal. Safeguarding and restoring biodiversity, creating climate smart alternative sources of bioenergy and soil improvement, and enhancing livelihoods and wellbeing. (30 words, maximum 30) CFUGS = Community-based Forest User Groups VDC = Village Development Committee VDCs are now restructured as Municipalities (MC) or Rural Municipalities (RMC). Site=For the purpose of the project, a site is cluster of 5 CFUGs in a district, project sites lie in Makawanpur (Province 3), Nawalpur (Province 4, Gandaki Pradesh) and Bardiya (Province 5) districts.	**0.1** 15 CFUGS (representing 750 households/3750 people(of which 2000 are women) in 3 sites (one each in Nawalpur, Bardiya and Makwanpur) engaged in capacity building activities and provided with a clear understanding of invasive plants and climate reliance /adaptation methodologies by Year 1, actively implementing invasive plant management guidelines by Year 2. **0.2** 30% of invasive species-dominated forest areas (both natural and managed, total area of infested forests in 3 sites established in Year 1 baseline survey) restored, with the management of regrowth of native species undertaken, and nursery areas for replanting established or linked with 15 Community Forests and private lands by Year 3. **0.3** Establishment of a comprehensive science-based knowledge-base for weed species in Community Forests and agricultural ecosystems in 3 districts of Nepal, including horizon scanning for potential future invasive plants, by Year 2 **0.4** Public awareness raised of the 20 nationally most problematic invasive	**0.1** MC/RMC annual reports, interviews with CFUGS, project reports on workshops, training and invasive plant management guidelines. **0.2** MC/RMC annual reports, interviews with CFUGS, photographs, land-use survey project reports. **0.3.** Fieldwork and weed survey project report, project publications. **0.4.** Media articles, invasive plant manual, interviews with CFUGS, household socio-economic survey reports. **0.5.** Household socio-economic survey project reports, interviews with women's groups, women's group records/annual reports. **0.6** MC/RMC annual reports, bioenergy project reports. **0.7** District Forest Officer annual report verifies progress of change of CFUG members livelihoods.	**1.** The political situation in Nepal remains stable to permit work, and that earthquakes, landslides and other natural disasters present no more than short-term obstacles. ***Mitigation:*** Partners are not politically aligned and have been able to work effectively under past regimes. Similarly, partners are experienced in coping with extreme environmental conditions and can schedule work to minimise impact. **2.** Local communities actively engage with the activities of the project. ***Mitigation:*** We will work with local communities within the established MSFP network as trust and effective, two-way communication are already set up and proven successful. **3.** Local communities recognise the economic, health and environmental benefits from management practices and technologies and decide to adopt them. ***Mitigation:*** Local communities will be deeply involved in training and

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	plants in Nepal; 15 CFUGS capable of identifying all local invasive plants and reporting new plant invaders in their local area; and 750 rural households (disaggregated by gender) empowered with knowledge on uses of invasive plants to improve livelihoods by Year 3. **0.5** With reference to Government of Nepal 2011 Census data and Year 1 baseline socio-economic survey data, 350 rural households adopt and use improved cooking stoves (ICS), resulting in 30% reduction reported in the use of wood as the primary fuel by end of Year 3, and contributing to reported enhanced wellbeing of household members. **0.6** 3 local women's groups (including people from ca. 30 households) with enhanced livelihoods by producing and deriving incomes from char out of invasive alien species by end of Year 3. **0.7** Low-tech, local biochar manufacture facilities established in 3 MC/RMCs, 15 CFUGS using biochar to increase soil fertility and sequester carbon in restored lands by Year 3.		information sharing events, promoting engagement and understanding. **4.** Household members (particularly women) recognise the benefits to themselves and the environment, and are self-motivated to adopt ICS and change from traditional cooking stoves, and using biochar. ***Mitigation:*** Heads of households will be engaged and informed on the personal livelihood and wellbeing benefits of ICS, in addition to the wider environmental benefits. Partners provide information with engaging audio-visual aids and technology with good coordination. **5.** Partners involved remain committed to the project. ***Mitigation:*** Partners have an excellent track record in collaborative projects, and this will be maintained through regular communication and involvement in monitoring and evaluation. **6.** The recent fuel crisis in Nepal caused severe transport problems and critical shortages of gas for cooking and heating. A benefit has been the raised awareness for alternative bioenergy sources, demand for bio-briquettes and pellets has far outstripped demand. Furthermore, wood was imported into Kathmandu (under rationing) putting forests under pressure.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
			Mitigation: partners are experienced in working during periods of fuel shortages and adapt workplans to cater for restrictions.
Outputs 1 Capacity for managing and controlling invasive plants built, practical control methods employed, and restoration of land degraded by invasive plants into economically and environmentally beneficial habitats initiated in 15 CFUGS.	**1.1** 15 CFUGS in 3 districts of Nepal are engaged in training and provided with management guidelines, training and supervision, and practical guidance in managing and controlling invasive plants by Year 1. Best practices incorporated into CFUGS management plants **1.2** 15 CFUGS engaged in practical control measures for invasive plants undertaken in 15 Community Forests and private lands by Year 2, and effective management of regrowth/seedlings of invasive plants undertaken by Year 3. Checks on active cultivation of alien species as a bioenergy source undertaken in Years 2 and 3. **1.3** Selection and documentation of 15 native, economically and/or environmentally important plants which are suitable for use in restoring degraded habitats (e.g. cleared of invasive plants) by Year 1. Nursery areas established in or existing nurseries linked with 15 CFUGS by Year 3. **1.4** 15 CFUGS engaged in initiating forest restoration plans, including replanting of native species in 15 areas cleared of invasive plants by Year 3.	**1.1** Project workshop reports, guideline documents, CFUGS interviews and management plans. **1.2** CFUGS interviews, fieldwork surveys, project reports. **1.3** Replanting guidelines project report, Government policy brief. **1.4** Interviews with CFUGS and households, photographs, fieldwork surveys, project reports.	Assumptions as above, especially 2 & 3.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
Output 2 Weed species researched and evaluated, and local community understanding of invasive plants enhanced. A national list of priority invasive plants established, supported by a bilingual identification manual and	**2.1** Science-based inventory of weed species in 3 districts of Nepal completed in Year 2, highlighting known invasive plants and spotlighting potential future problematic species. At least 20 MSc students trained in fieldwork techniques. **2.2** 15 CFUGS with enhanced understanding of local invasive plants and skills in identifying new invasive and potentially problematic plants, and CFUG Management Plans updated by Year 3. **2.3** Evidence-based national list of 30-40 priority invasive species compiled and documented, and submitted to Government of Nepal to underpin policy decisions by Year 2. **2.4** GIS niche modelling of 10 potentially invasive species undertaken, and horizon scanning reported to Government of Nepal by Year 3. Pilot study applying Remote Sensing methodologies to detect *Lantana camara* and two other invasive species completed by Year 3. **2.5.** Bilingual identification manual covering the national priority invasive plant species published and 20 monthly newspaper and online popular articles featuring invasive plants published by Year 3. **2.6** Project website established in Year 1 and used to give free and open access	**2.1** Annotated inventory of weed species project report, fieldwork reports. **2.2** Interviews with CFUGS, project workshop reports. **2.3** National priority invasive plant report submitted to Government of Nepal. **2.4** Invasive plant species horizon scanning project report, research paper submitted to international peer-reviewed journal. **2.5** Published identification manual, articles in national newspapers and online (e.g. project website). **2.6** Project website.	Assumptions as above, especially 2 & 3.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	to project reports and other outputs during the project.		
Output 3 Charcoal production facilities successfully introduced and communities are linked up with market facilities. Small-scale women-run co-operatives derive alternative incomes from Char. Improved Cooking Stoves (ICS) successfully installed, and contributing to reduced use of wood and enhanced wellbeing of household members.	**3.1** 15 CFUGS and 7 Women's Groups, representing ca. 4000 individuals (at least half of which are women or girls), provided with information resources and engaged in practical training on the species selection and use of invasive plants and other waste biomass (e.g. fallen leaves) for producing char by Year 1 **3.2** 30 women from local women's groups recruited for training in char manufacture, at least 3 co-operatives/enterprises set up with employment to 21 people (women/target community), which produce and market ca. 45 metric tons of charcoal by Year 3. This contributes generating an additional NRS 650,000 (£4500) and enhancing livelihoods of poor communities. **3.3** 350 rural households (30% increase from 2011 census baseline) adopting ICS as an efficient and primary cooking stove thereby reducing firewood consumption improving health, reducing indoor air pollution, and reducing time spent collecting firewood by Year 3.	**3.1** Interviews with CFUGS and Women's Groups, workshop reports, bioenergy project report. **3.2** Interviews with Women's Groups, Women's Group records, photographs, project reports and socio-economic survey. **3.3** Household socio-economic survey, photographs, project report. **3.4** District Forest Officer annual report verifies progress of change of CFUG members livelihoods.	Assumptions as above, especially 2, 3 & 4.
Output 4 Biochar technologies successfully introduced, biochar manufactured locally and used to improve soil fertility of degraded land and to sequester carbon. Compost plant established to produce compost from invasive species.	**4.1** 15 CFUG, representing 750 rural households, provided with information resources and practical training on the species selection and use of invasive plants for producing biochar by Year 1. **4.2** Local biochar production facilities, using appropriate low-tech technologies,	**4.1** Interviews with CFUGS, workshop reports, project reports. **4.2** MC/RMC annual report, workshop reports, photographs, bioenergy project report. **4.3** MC/RMC annual report,	Assumptions as above, especially 2, 3 & 4.

Project summary	Measurable Indicators	Means of verification	Important Assumptions
	established and manufacturing biochar in 3 sites by Year 2. Compost plant to produce compost from invasive plants established in Y3. 90 metric tons of biochar and compost produced by end of Year 3. **4.3** 15 CFUGS using biochar to increase soil fertility and sequester carbon, and 20% of households using biochar and compost from invasive species for soil improvement, with estimated increase in crop yields of 20% by end of Year 3 improving livelihoods and income generation potential.	photographs, project report.	

Activities

Output 1. Invasive plants controlled and degraded lands restored

1.1 Hold planning and stakeholder workshops, taking a participatory approach to providing training, enhancing the knowledge of local communities and raising awareness on the identification, impact, control and management of invasive plants.

1.2 Work with CBFUGs to undertake effective practical action for the removal and on-going control of invasive plants, with training and support, and assess the impact of this work.

1.3 Hold meetings with experts to agree on target species for replanting and work with government and local plant nurseries, and CBFUGs, to undertake replanting of reclaimed lands with native, economically useful plants.

1.4 Research, build and disseminate a science-based knowledge resource for invasive plants, and take a participatory approach to incorporating into CBFUG Management Plans the lessons learned in best practice in restoration of lands degraded by invasive plants.

Output 2, Weed species evaluated and communicated

2.1 Research, evaluate and publish inventories of the district-level weed flora in the study areas with fieldwork, sample collection and identification, enhancing reference collections, and training and capacity building of MSc students.

2.2 Research and evaluate a national list of priority invasive species, and submit a report through Government partners to inform Government of Nepal policy.

2.3 Research, develop and publish a photographic identification manual (and other educational materials on a project website), tested by communities, to inform and raise awareness of invasive plants both at a local level with communities and nationally with the general public.

2.4 Use the improved species distribution mapping to investigate the likely unrestricted spread of 10 current or potentially invasive plants using GIS niche modelling techniques, and undertake a Remote Sensing pilot study on one high-priority problem species, submitting papers for publication.

Output 3. Char production facilities successfully established and linked with the market to sell char

3.1 Hold workshops and meetings with community stakeholders to inform and train people in the use of invasive plant biomass, and other waste plant material (e.g. dead leaves,) to

Project summary	Measurable Indicators	Means of verification	Important Assumptions
produce char through pyrolysis. **3.2** Provide capacity building to local stakeholder groups in the formation of cooperatives for char production, which have the necessary equipment, technological knowledge and practical experience. **3.3** Support local cooperatives in the production, distribution, marketing of char for income generation. **3.4** Hold practical and theoretical workshops for installation of Improved Cooking Stoves (ICS). Provide support for the installation of ICS. **3.5** Undertake base line and monitoring socio-economic surveys to assess impact and benefits of introducing char production and installation of ICS on livelihoods and well-being and incorporating best practice into CBFUG Management Plans. **Output 4. Biochar technologies successfully implemented** **4.1** Hold workshops and meetings with community stakeholders to inform and train people in the use of invasive plant biomass, and other waste plant material, to produce biochar and compost **4.2** Provide capacity building and support the establishment of low-tech pyrolysis methods for biochar production and compost plant, and the use of biochar and compost to improve the soil fertility of land reclaimed from invasive weed infestations. **4.3** Undertake base line and monitoring surveys to assess the impact and benefits of biochar and compost production and its use in improving soil fertility, restoration of lands cleared of infestations and crop yields, incorporating best practice into CBFUG Management Plans			

Annex 2 Report of progress and achievements against final project logframe for the life of the project

Project summary	Measurable Indicators	Progress and Achievements
Impact: Reduction and ultimate eradication of invasive plants in forests, farmland and wild habitats in Nepal: improving biosecurity, safeguarding globally significant biodiversity, and improving livelihoods and wellbeing of natural resource-dependent people.		Although the full Impact Statement of the project will be achieved in the years ahead, the activities of the project have already shown some direct positive impacts on biodiversity and poverty alleviation. 481 ha of Community Forest have now been cleared of invasive species and restored by the planting of more than 31,000 saplings/seedlings of 20 economically useful native species (Sup. Doc. 32, 40). Disadvantaged and marginalised poor people have made extra income of NRS 600,000 by selling char made from waste biomass (Sup. Doc. 34, 40), and they have been using some of the income to fund the establishment of new income generation enterprises such as vegetable farming and rearing of goats. More than 200 rural household are now benefitting from smoke free kitchens through the use of energy efficient Improved Cooking Stoves. These stoves have reduced the firewood consumption in these households by 60%, thereby reducing the pressure on local forest resources. Women have reported a 50% saving in time spent cooking, and incidences of smoke-related illness have been reduced (Sup. Doc. 40). Local people have benefitted by increases in crop yield (20% in average) through the use of activated biochar as a soil improver (Sup. Doc. 40).
Outcome Increased knowledge, awareness and effective management of invasive plants in Nepal. Safeguarding and restoring biodiversity, creating climate smart alternative sources of bioenergy and soil improvement, and enhancing livelihoods and wellbeing. **Abbreviations:** AIPS = Alien Invasive Plant Species TU-CDB = Central Department of Botany, Tribhuvan University CFUGS = Community-based Forest User Groups NAST = Nepal Academy of Science and Technology Sup. Doc. = Supporting Document VDC = Village Development Committee VDCs are now restructured as Municipalities (MC) or Rural Municipalities (RMC).	**0.1 15 CFUGS** (representing 750 households/3750 people(of which 2000 are women) in 3 sites (one each in Nawalpur, Bardiya and Makwanpur) engaged in capacity building activities and provided with a clear understanding of invasive plants and climate reliance /adaptation methodologies by Year 1, actively implementing invasive plant management guidelines by Year 2. **0.2 30%** of invasive species-dominated forest areas (both natural and managed, total area of infested forests in 3 sites established in Year 1 baseline survey) restored, with the management of regrowth of native species undertaken, and nursery areas for replanting established or linked with **15** Community Forests and private lands by Year 3.	**0.1** 9 major workshops were completed,3 in each of the project sites, involving **15 CFUGs (**representing 5120 households/27814 people) (Sup. Doc. 3-11): **614** people (more than 50% female) were actively involved in the extensive training workshops; **706** people participated in the awareness programs (Sup. Doc. 3-11, 27-29). **3100** households, including more than **5000** people, were involved in clearing of AIPS following revised management guidelines; and **1000** households were involved in the restoration plantation programme (Sup. Doc. 32). More than **50%** of local people can now easily identify AIPS in their community forests (Sup.Doc.40). **0.2** A total of **2325 ha** of invaded forest was identified during the baseline study in the 3 sites (Sup.Doc. 1), with about 50% of this total area dominated by AIPS . By Year 3 **481 ha** of infested forest area had been cleared and undergoing restoration (Sup. Doc. 32) which represents **41%** of the AIPS -dominated forest area across the 3 sites. All **15 CFUGs** were linked with their local District Forest Offices for the provision of seedlings for replanting. **31,000** seedlings of **20** different species of economically important useful native plants were planted (Sup. Doc. 33).

Project summary	Measurable Indicators	Progress and Achievements
	0.3 Establishment of a comprehensive science-based knowledge-base for weed species in Community Forests and agricultural ecosystems in **3 districts** of Nepal, including horizon scanning for potential future invasive plants, by Year 2	**0.3 3 MSc students** from TU-CDB Postgraduate Research Programme completed their Master's thesis on naturalized species in **3 districts** (Sup. Doc. 18-20). **2141** data-rich, accurately identified herbarium specimens of invasive plants and associated species were collected and submitted to Tribhuvan University Central Herbarium. Distribution mapping of AIPS was completed at **76 locations in 8 Districts** (Sup. Doc. 23). Students categorised the inventory of flora into native and naturalised alien species, some of those could potentially be problematic in the future. This horizon scanning was included in advice to Government.
	0.4 Public awareness raised of the **20** nationally most problematic AIPS in Nepal; **15 CFUGS** capable of identifying all local invasive plants and reporting new plant invaders in their local area; and **750** rural households (disaggregated by gender) empowered with knowledge on uses of invasive plants to improve livelihoods by Year 3.	**0.4 7** articles on AIPS and focussing on our activities have been published in major popular media in Nepal (Sup. Doc. 31). An awareness raising article on AIPS of Nepal (in Nepali) has been published in "Hamro Ban Sampada" www.forestaction.org/publications/view/251 (Sup. Doc. 17). A brochure in Nepali was produced in Y1 for raising awareness on AIPS (Sup. Doc. 2) and distributed in all sites. Manuals covering **26** nationally most problematic AIPS were published, tested with communities, and revised (Sup. Doc.39). The manual will be published as a book in October 2019 by NAST. A poster covering **26** most problematic AIPS was designed, printed and 1000 copies distributed throughout Nepal (Sup. Doc.12). The poster is first of its kind ever published in Nepal, and is very popular and useful among the communities to identify AIPS of Nepal. An interview with experts working in AIPS in Nepal was broadcast by NTV (Nepal's National Television), covering the project activities and the workshop on the impact assessment of AIPS of Nepal. www.youtube.com/watch?v=8OK4WLvb9Ys. More the **50 %** of people in **15 CFUGS** are now capable of identifying local AIPS (Sup.Doc. 40), and more than **1000** rural households empowered with knowledge on use of AIPS to improve livelihoods.
	0.5 With reference to Government of Nepal 2011 Census data and Year 1 baseline socio-economic survey data, **350** rural households adopt and use improved cooking stoves (ICS), resulting in **30% reduction** reported in the use of wood as the primary fuel by end of Year 3, and contributing to reported **enhanced wellbeing** of household members.	**0.5 351** rural households provided with improved cooking stoves (ICS) and trained in their use, with 60% installed and operational (Sup. Doc.13-15.). The beneficiaries survey shows the **60 % reduction** in the use of wood by using ICS (Sup.Doc.40). The report also shows the **80% reduction of smoke** thereby enhancing wellbeing of women and children who spent most of their time in the kitchen. (Sup. Doc. 40).

Project summary	Measurable Indicators	Progress and Achievements
	0.6 3 local women's groups (including people from ca. **30 households**) with enhanced livelihoods by producing and deriving incomes from char out of invasive alien species by end of Year 3.	**0.6 3 women groups** (2 formally formed) comprising **40** households produced over 60 tons of char; and made an income of NRS 600,000 (£4,400) (Sup. Doc. 34,40).
	0.7 Low-tech, local biochar manufacture facilities established in **3 MC/RMCs**, **15 CFUGS** using biochar to increase soil fertility and sequester carbon in restored lands by Year 3.	**0.7** Bio-char technology has been introduced in **15 CFUGs** (Sup. Doc. 3-11) across the **3 MC/RMCs** involved in the project. MSc student Pratibha Poudel completed her Master thesis on carbon sequestration and soil amendments through biochar made from invasive species in Nawalparasi district (Sup. Doc. 21). This study showed significant improvement in soil quality ($p<0.05$, increased potassium and carbon) after the application of biochar made from *Chromolaena odorata*. The results also showed an increase in crop yield of around **16 %**, and estimated that the total amount of carbon sequestered during the project period was **25 tons**.
Output 1. Capacity for managing and controlling invasive plants built, practical control methods employed, and restoration of land degraded by invasive plants into economically and environmentally beneficial habitats initiated in 15 CFUGS.	**1.1 15 CFUGS** in 3 districts of Nepal are engaged in training and provided with management guidelines, training and supervision, and practical guidance in managing and controlling invasive plants by Year 1. Best practices incorporated into CFUGS management plants.	**1.1 9** major workshops completed in three districts involving all **15 CFUGs** (Sup. Doc. 3-11). Project officers at NAST and ForestAction, and local facilitators were actively involved with communities for on the ground support and guidance throughout the project. The AIPS poster was used for training, to raise awareness and to help with the identification of invasive species (Sup. Doc. 12). Best practices for the management of AIPS are being incorporated in CFUG management plans (Sup. Doc. 32). A brochure in Nepali was produced in Y1 for raising awareness of AIPS (Sup. Doc. 2) Journal article in Nepali was published on management of AIPS in community forests to raise awareness at different levels (Sup. Doc.17).
	1.2 15 CFUGS engaged in practical control measures for invasive plants undertaken in 15 Community Forests and private lands by Year 2, and effective management of regrowth/seedlings of invasive plants undertaken by Year 3. Checks on active cultivation of alien species as a bioenergy source undertaken in Years 2 and 3.	**1.2 15 CFUGS** continue to be actively involved in AIPS clearing. During the project they cleared **481** ha (80 Y1 + 156 Y2 + 245 Y3) of infested forest by end of Y3 (Sup. Doc. 32,40). CFUGs are actively managing the regrowth of AIPS, and are well aware on the consequences of planting of AIPS (Sup.Doc.33).
	1.3 Selection and documentation of **15** native, economically and/or environmentally important plants which are suitable for use in restoring degraded habitats (e.g. cleared of invasive plants) by Year 1. Nursery areas established in or existing	**1.3** A total of **20 native species** were selected and incorporated into the restoration planting schemes (Sup. Doc. 33). All **15 CFUGs** were successfully partnered with District Forest Office nurseries, have received seedlings and have been involved with restoration planting of degraded lands.

Project summary	Measurable Indicators	Progress and Achievements
	nurseries linked with 15 CFUGS by Year 3. **1.4 15 CFUGS** engaged in initiating forest restoration plans, including replanting of native species in **15 areas** cleared of invasive plants by Year 3.	**1.4** Forest restoration plans and replanting of native species was undertaken for areas in all **15 CFUG** sites. **31,000 seedlings of 20 native species** were planted during the project period (Sup. Doc. 33).
Activity 1.1 Hold planning and stakeholder workshops, taking a participatory approach to providing training, enhancing the knowledge of local communities and raising awareness on the identification, impact, control and management of invasive plants.		Nine major workshops in three districts completed (Sup. Doc. 3-11). Yearly removal and management of invasive species is now incorporated in 3 CFUG operational plans (Sup. Doc.32). The other CFUGs have adopted management practices and pledged that they will update their operational plants at the next revision.
Activity 1.2 Work with CFUGs to undertake effective practical action for the removal and on-going control of invasive plants, with training and support, and assess the impact of this work.		During the project period the project team worked with local communities in the CFUGs to clear 481 ha of infested forest, with ongoing control and monitoring (Sup. Doc. 32).
Activity 1.3 Hold meetings with experts to agree on target species for replanting and work with government and local plant nurseries, and CFUGs, to undertake replanting of reclaimed lands with native, economically useful plants.		Based on the interests of the local people and expert advice, 20 native and economically useful species were collaboratively selected for planting. A total of 31,000 seedlings were planted for the restoration of degraded land (Sup. Doc. 33).
Activity 1.4 Research, build and disseminate a science-based knowledge resource for invasive plants, and take a participatory approach to incorporating into CFUG Management Plans the lessons learned in best practice in restoration of lands degraded by invasive plants.		Local people were involved in the design and composition of the science-based knowledge products so that they best met their needs. These have been uploaded to the project website (http://www.invasiveplantsnepal.org) with open access. An awareness raising article in Nepali was published Hamro Ban Sampada" vol. 14 (Sup. Doc. 17), and is freely available to download from www.forestaction.org/publications/view/251 Three CFUGs management plans were formally updated and approved to incorporate best practices on restoration of land degraded by invasive species (Sup. Doc. 32). The others have pledged to update their management plans when they next revise their operational plans. 1000 copies of the poster covering 26 the most problematic AIPS was published Sup. Doc.12) and distributed all over the country.
Output 2. Weed species researched and evaluated and local community understanding of invasive plants enhanced. A national list of priority invasive plants established, supported by a bilingual identification manual and the raising of public awareness.	**2.1** Science-based inventory of weed species in **3 districts** of Nepal completed in Year 2, highlighting known invasive plants and spotlighting potential future problematic species. At least **20 MSc students** trained in fieldwork techniques.	**2.1 3 MSc students** successfully completed their MSc thesis based on inventory of weed species as part of the project. **2141** herbarium specimens and associated data were collected by the students, accurately identified, mounted and deposited at Tribhuvan University Central Herbarium (TUCH) (Sup. Doc. 18-20, sample specimen image Sup. Doc. 35). Specimens were digitized and data uploaded to GBIF(www.gbif.org) where it is freely available (undertaken through an **externally funded BIFA project,** Sup. Doc. 25, (https://www.gbif.org/project/3IvP2nISis66g6ceka6C8e/mobilizing-occurrence-data-of-alien-and-endemic-plant-species-of-nepal#datasets).). Distribution mapping of AIPS was undertaken for mid-western Nepal at **76 locations in 8 Districts** (Sup. Doc. 23). **59 MSc students** were trained on fieldwork techniques, herbarium

Project summary	Measurable Indicators	Progress and Achievements
		specimen preparation and plant identification (Sup. Doc. 24). A camera-based digitization unit at Nepal's National Herbarium (KATH) was setup and staff trained on the digitization process: this has tripled the rate of specimen digitization and leaving a lasting legacy for mobilising historic herbarium specimen data for biodiversity research (Sup. Doc. 36).
	2.2 15 CFUGS with enhanced understanding of local invasive plants and skills in identifying new invasive and potentially problematic plants, and CFUG Management Plans updated by Year 3.	**2.2** Identification manuals for **26 problematic AIPS** of Nepal have been created and tested with all **15 CFUGs** involved in the project (Sup. Doc. 39). The front and end matters are being finalized, and the manual will be published as a book in October 2019. At least **50%** of local CFUGs are now capable of identifying AIPS in their forest and private lands (Sup. Doc. 40). CFUG Management Plans (MP) were updated for 3 Community Forests. Due to current political restructuring in Nepal other CFs have pledged to update their MPs when they next revise their Operational Plans.
	2.3 Evidence-based national list of 30-**40 priority invasive species** compiled and documented, and submitted to Government of Nepal to underpin policy decisions by Year 2.	**2.3** A multi-stakeholder workshop undertook an impact assessment of AIPSspecies of Nepal in May 2018 (Sup. Doc. 16). Evidence-based assessments (using under development IUCN guidelines) were undertaken for **26** species. The results were submitted to Government of Nepal and have been included in Nepal's **6th National Report** to the Convention on Biological Diversity (Sup. Doc. 22, page 66).
	2.4 GIS niche modelling of **10 potentially invasive species** undertaken, and horizon scanning reported to Government of Nepal by Year 3. Pilot study applying Remote Sensing methodologies to detect *Lantana camara* and two other invasive species completed by Year 3.	**2.4** GIS niche modelling of **24 species** was undertaken using data collected during field work, incorporating data from other linked projects. The results were published in *Diversity and Distribution* (Sup. Doc. 30); https://onlinelibrary.wiley.com/doi/epdf/10.1111/ddi.12963).These results, and comments on horizon scanning, were reported to Government of Nepal along with impact assessments (see. 2.3). Mapping of *Chromolaena odorata* using Remote Sensing analysis was completed (Sup. Doc. 42). The draft manuscript is being finalized for publication. The robust analysis for *Chromoaleana odorata* was done using the high-resolution image data, and we managed to complete the analysis for one species, and two are in preparation.
	2.5. Bilingual identification manual covering the national priority invasive plant species published and 20 monthly newspaper and online popular articles featuring invasive plants published by Year 3.	**2.5** Bilingual identification manual was published (Sup. Doc. 39) and tested with local communities. The manual is available electronically on the project website (http://www.invasiveplantsnepal.org/invasive-plants/), and will be published as a book in September 2019. 10 newspaper articles on invasive plants were published (Sup. Doc. 31). A picture stories covering **11** most problematic AIPS of Nepal was submitted to BBC Nepali, and was accepted for publication.

Project summary	Measurable Indicators	Progress and Achievements
	2.6 Project website established in Year 1 and used to give free and open access to project reports and other outputs during the project.	**2.6** Project website was established in Y1 (www.invasiveplantsnepal.org). All reports and other publications are freely available as downloads, along with information and images of project activities and the invasive plant profiles.
Activity 2.1. Research, evaluate and publish inventories of the district-level weed flora in the study areas with fieldwork, sample collection and identification, enhancing reference collections, and training and capacity building of MSc students.		Three MSc students completed their master thesis with grade A (highest grade in TU) on inventories of naturalized species in three districts (Sup. Doc. 18-20). Altogether 2141 specimens were collected and deposited at TUCH. MSc students visited CAL herbaria for training and identification of plant species (Sup. Doc. 26, page 8, Sup. Doc. 23).Two of the MSc thesis students, Ganesh D Joshi and Rashmi Paudel, presented their results at the '4th Graduate Conference on Environment and Sustainable Development', and Rashmi was awarded as the best oral presenter of the conference among the graduate students (Sup. Doc. 23). Inventories are published in the MSc theses and included in data available on GBIF. The MSc students visited the National Herbarium of India (CAL) in Kolkata for training and to undertake the identification of their specimens collected during field trips (Sup. Doc. 26, page 8; Sup. Doc. 23). 59 MSc students were trained on fieldwork techniques, herbarium preparation and plant identification (Sup. Doc. 24).
Activity 2.2. Activity 2.2. Research and evaluate a national list of priority invasive species and submit a report through Government partners to inform Government of Nepal policy.		Workshop on impact assessment of invasive alien plant species of Nepal was conducted in May 17-18, 2018 (Sup. Doc.16). 28 experts from government and non-governmental organizations participated in the workshop. The programme was recorded, and highlights broadcasted in Nepal's national television NTV on 26th May 2018, including interviews with experts on the problem of invasive alien species of Nepal and it's management strategies. The video is available at: https://www.youtube.com/watch?v=8OK4WLvb9Ys. The results of the workshop were shared with the government of Nepal and was included in Nepal's 6th National Report to the Convention on Biological Diversity (Sup. Doc. 22, page 66).
Activity 2.3 Research, develop and publish a photographic identification manual (and other educational materials on a project website), tested by communities, to inform and raise awareness of invasive plants both at a local level with communities and nationally with the general public.		A bilingual identification manual was researched, developed and published (Sup. Doc. 39) with input from CFUGs. It was tested with local communities impacted by invasive plants, generating interest and raising awareness. The manual is published on the project website (http://www.invasiveplantsnepal.org/invasive-plants/), along with the poster, images, brochure, etc.
Activity 2.4 Use the improved species distribution mapping to investigate the likely unrestricted spread of 10 current or potentially invasive plants using GIS niche modelling techniques and undertake a Remote Sensing pilot study on one high-priority problem species, submitting papers for publication.		GIS climatic modelling of 24 species was undertaken using data collected during field work, and from other projects led by TU-CDB in Nepal. The results were published in Diversity and Distribution (Sup. Doc. 30; https://onlinelibrary.wiley.com/doi/epdf/10.1111/ddi.12963).

Project summary	Measurable Indicators	Progress and Achievements
		Remote sensing mapping of *Chromolaena odorata,* one of the highly problematic species, using remote sensing analysis was completed (Sup. Doc.42). The draft manuscript is being finalized for publication.
Output 3. Charcoal production facilities successfully introduced, and communities are linked up with market facilities. Small-scale women-run co-operatives derive alternative incomes from Char. Improved Cooking Stoves (ICS) successfully installed and contributing to reduced use of wood and enhanced wellbeing of household members.	**3.1 15 CFUGS** and **7 Women's Groups**, representing ca. **4000** individuals (at least half of which are women or girls), provided with information resources and engaged in practical training on the species selection and use of invasive plants and other waste biomass (e.g. fallen leaves) for producing char by Year 1	**3.1** Theoretical and practical trainings provided on selection of species used in the production of char in all **15 CFUGs** (including ca. **5000** people, more than 50% of whom are women, Sup. Doc. 3-8, 32) in Y1 and Y2.
	3.2 30 women from local women's groups recruited for training in char manufacture, at least **3 co-operatives/enterprises** set up with employment to **21 people** (women/target community), which produce and market ca. **45 metric tons** of charcoal by Year 3. This contributes generating an additional **NRS 650,000** (£4500) and enhancing livelihoods of poor communities.	**3.2** More than **50 tons** of char was produced and sold in the market generating an income of over **Nrs 600,000** in Makwanpur and Nawalparasi district (Sup. Doc. 32). More than **40 women** from marginalized and disadvantaged communities have been involved in char production. **Two women groups** were formed in Makwanpur district. They have used money generated from the sale of char production and used it, with support from the project, to undertake other income generation activities, such as vegetable farming and goat rearing (Sup. Doc. 34). In Bardiya district, the local people are only interested in biochar due to the absence of a market for char.
	3.3 350 rural households (30% increase from 2011 census baseline) adopting ICS as an efficient and primary cooking stove thereby reducing firewood consumption improving health, reducing indoor air pollution, and reducing time spent collecting firewood by Year 3.	**3.3 34 people** (26 women) received enhanced training on manufacture and installation of ICS. **351 rural households** were provided with ICS, with more than 80% of these already adopting ICS as their primary cooking stove, bringing health benefits to more than 2000 people and reducing firewood consumption (Sup. Doc. 13 -15). These activities have generated a lot of interest in ICS and uptake of this technology is continuing to rise. Women trained in manufacture and installation are able to gain extra income by installing ICS for others in their communities.
Activity 3.1 Hold workshops and meetings with community stakeholders to inform and train people in the use of invasive plant biomass, and other waste plant material (e.g. dead leaves,) to produce char through pyrolysis.		Theoretical and practical training provided on selection of species and production of char in all CFUGs (more than 50% of the participants were women, Sup. Doc. 3 - 8) in Y1 and Y2.
Activity 3.2 Provide capacity building to local stakeholder groups in the formation of cooperatives for char production, which have the necessary equipment, technological knowledge and practical experience.		Capacity building for char production was completed and equipment supplied. Two women groups were formally formed and have been actively involved in producing char from AIPS. The business plan to run local informal cooperatives to generate extra income to improve the livelihood was written (Sup. Doc. 34).

Project summary	Measurable Indicators	Progress and Achievements
Activity 3.3 Support local cooperatives in the production, distribution, marketing of char for income generation.		The local cooperatives were supported in producing and selling char, and have earnt an income of over Nrs 600,000 (Sup. Doc. 32). They are now also involved in other income generating activities such as vegetable farming and goat rearing.
Activity 3.4 Hold practical and theoretical workshops for installation of Improved Cooking Stoves (ICS). Provide support for the installation of ICS.		34 people (26 of them are women) were provided with enhanced training on installation of ICS. Total of 351 ICS was distributed and are already benefitting more than 1000 people (Sup. Doc.13-15).
Activity 3.5 Undertake base line and monitoring socio-economic surveys to assess impact and benefits of introducing char production and installation of ICS on livelihoods and well-being and incorporating best practice into CBFUG Management Plans.		The average income of 40 poor char-producing households increased by 25% (Sup. Doc. 40) after updating CBFUG management plans. The use of ICS has reduced the firewood consumption by 60%, and saved cooking time by 50% (Sup. Doc. 40). People have said this has also improved their living conditions with the reduction in smoke in the kitchens.
Output 4 Biochar technologies successfully introduced, biochar manufactured locally and used to improve soil fertility of degraded land and to sequester carbon. Compost plant established to produce compost from invasive species.	**4.1 15 CFUGs**, representing **750 rural households**, provided with information resources and practical training on the species selection and use of invasive plants for producing biochar by Year 1.	**4.1** Practical training in biochar technologies and species selection completed in all **15 CFUGs** in 3 districts (Sup. Doc. 3-11), involving around **700** rural households. They have been provided with information resources developed by NAST.
	4.2 Local biochar production facilities, using appropriate low-tech technologies, established and manufacturing biochar in **3 sites** by Year 2. Compost plant to produce compost from invasive plants established in Y3. **90 metric tons** of biochar and compost produced by end of Year 3.	**4.2** Local biochar production facilities established in **3 sites** and provided with equipment's and resources (Sup. Doc. 3-11). Field demonstration areas were established at all 3 sites to show the impact of using biochar as a soil improver benefitting crop yield. More than 25 metric tons of biochar was produced during the project. To raise awareness and highlight the importance of biochar, a biochar day was celebrated in Bardiya and Makwanpur districts (Sup. Doc. 28, 29). Biochar Committees were formed in each district (each with 12-15 members), with the committees agreeing to continue activities related to managing AIPS in their Community Forests and private lands (Sup. Doc. 37). A Compost Plant was established in 2019 to produce compost from invasive species, but there were delays in compost production due to the changes in CFUG Executive Committee (Sup. Doc. 32). CFUG leaders agreed to start producing compost by the end of the 2019.
	4.3 15 CFUGS using biochar to increase soil fertility and sequester carbon, and **20% of households** using biochar and compost from invasive species for soil improvement, with estimated **increase in crop yields of 20%** by end of Year 3 improving livelihoods and income generation	**4.3** All CFUGs produced biochar as a community enterprise, and members also produced biochar to apply in their fields. Around **50%** of households have started producing and using the biochar (Sup.Doc. 40).The result of MSc thesis demonstrated an **increase in crop yield of around 16%** using the biochar made from *Chormolaena odorata* (Sup. Doc. 21).

Project summary	Measurable Indicators	Progress and Achievements
	potential.	
Activity 4.1 Hold workshops and meetings with community stakeholders to inform and train people in the use of invasive plant biomass, and other waste plant material, to produce biochar and compost		Nine major workshops (3 in each districts) were conducted in three districts (Sup. Doc. 3-11). Other formal and informal meetings were organized to help communities to prepare biochar and to raise awareness (Sup. Doc. 27, 28, 29).
Activity 4.2 Provide capacity building and support the establishment of low-tech pyrolysis methods for biochar production and compost plant, and the use of biochar and compost to improve the soil fertility of land reclaimed from invasive weed infestations.		Low tech pyrolysis methods for biochar production have been established at 3 sites representing all 15 CFUGs. Pyrolysis equipment was distributed to the community in all 3 sites (Sup. Doc. 3-11).
Activity 4.3 Undertake base line and monitoring surveys to assess the impact and benefits of biochar and compost production and its use in improving soil fertility, restoration of lands cleared of infestations and crop yields, incorporating best practice into CBFUG Management Plans		The research of MSc students shows the significant improvement of soil quality ($p<0.05$, increased potassium and carbon) after the application of biochar made from *Chromolaena odorata*. The results show the increase in crop yield by around 16%. After incorporating the best practices of producing char and biochar from invasive biomass into CBFUG plans, the survey shows households reported increases of 30% in the production of chilli peppers, and ca. 15% in other crops (Sup. Doc. 40).

Annex 3 Standard Measures

Code	Description	Total	Nationality	Gender	Title or Focus	Language	Comments
Training Measures							
1a	Number of people to submit PhD thesis						
1b	Number of PhD qualifications obtained						
2	Number of Masters qualifications obtained	4	Nepali	3F, 1 M	Alien flora, Biochar	English	
3	Number of other qualifications obtained						
4a	Number of undergraduate students receiving training						
4b	Number of training weeks provided to undergraduate students						
4c	Number of postgraduate students receiving training (not 1-3 above)	59	Nepali	35 F, 24M	Fieldwork techniques, herbarium preparation and plant identification	English, Nepali	
4d	Number of training weeks for postgraduate students						
5	Number of people receiving other forms of long-term (>1yr) training not leading to formal qualification (e.g., not categories 1-4 above)						
6a	Number of people receiving other forms of short-term education/training (e.g., not categories 1-5 above)	34	Nepali	26 F, 8 M	Installation of improved cooking stoves	Nepali	
6b	Number of training weeks not leading to formal qualification						

7	Number of types of training materials produced for use by host country(s) (describe training materials)	2			Identification manual of AIPS, ICS installation	Nepali, English	

Research Measures		**Total**	**Nationality**	**Gender**	**Title**	**Language**	**Comments/ Weblink if available**
9	Number of species/habitat management plans (or action plans) produced for Governments, public authorities or other implementing agencies in the host country (ies)						Participatory process?
10	Number of formal documents produced to assist work related to species identification, classification and recording.	2			Identification manual of 26 AIPS of Nepal, Poster of AIPS of Nepal	Nepali, English	
11a	Number of papers published or accepted for publication in peer reviewed journals	2 + 1				English	2 published, 1 submitted
11b	Number of papers published or accepted for publication elsewhere						
12a	Number of computer-based databases established (containing species/generic information) and handed over to host country						
12b	Number of computer-based databases enhanced (containing species/genetic information) and handed over to host country						
13a	Number of species reference collections established and handed over to host country(s)	2141			Herbarium specimens deposited at TUCH herbarium		

13b	Number of species reference collections enhanced and handed over to host country(s)	179			References collection localities and specimens		RBGE, DPR and TU-CDB joint expedition to collect data and herbarium specimens, funded by RBGE expedition fund.

Dissemination Measures		**Total**	**Nationality**	**Gender**	**Theme**	**Language**	**Comments**
14a	Number of conferences/seminars/workshops organised to present/disseminate findings from Darwin project work	13	11 Nepalese: 2 British	4F, 9M	Invasion Biology, digitization	English	
14b	Number of conferences/seminars/ workshops attended at which findings from Darwin project work will be presented/ disseminated.	1	British	F	Biodiversity Information, infrastructure	English	Biodiversity Next conference 22-25 October

Physical Measures		**Total**	**Comments**
20	Estimated value (£s) of physical assets handed over to host country(s)	17551	Computers, printers, biochar equipment, cameras, digitization unit
21	Number of permanent educational, training, research facilities or organisation established	1	Herbarium digitization unit in KATH herbarium
22	Number of permanent field plots established	0	Please describe

Financial Measures	**Total**	**Nationality**	**Gender**	**Theme**	**Language**	**Comments**

23	Value of additional resources raised from other sources (e.g., in addition to Darwin funding) for project work	183,688					

Annex 4 Aichi Targets

	Aichi Target	Tick if applicable to your project
1	People are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	√
2	Biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.	√
3	Incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio economic conditions.	
4	Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	
5	The rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and fragmentation is significantly reduced.	√
6	All fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	
7	Areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	√
8	Pollution, including from excess nutrients, has been brought to levels that are not detrimental to ecosystem function and biodiversity.	
9	Invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	√
10	The multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	
11	At least 17 per cent of terrestrial and inland water, and 10 per cent of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscapes and seascapes.	
12	The extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	
13	The genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.	

14	Ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	
15	Ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including restoration of at least 15 per cent of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.	
16	The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.	
17	Each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.	
18	The traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of indigenous and local communities, at all relevant levels.	
19	Knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	√
20	The mobilization of financial resources for effectively implementing the Strategic Plan for Biodiversity 2011-2020 from all sources, and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization should increase substantially from the current levels. This target will be subject to changes contingent to resource needs assessments to be developed and reported by Parties.	

Annex 5 Publications

Type * (e.g. journals, manual, CDs)	Detail (title, author, year)	Nationality of lead author	Nationality of institution of lead author	Gender of lead author	Publishers (name, city)	Available from (e.g. web link, contact address etc)
Brochure	Invasive species: An introduction (In Nepali)	Nepalese	Nepal	Male	ForestAction Nepal	http://www.invasiveplantsnepal.org/wp-content/uploads/2017/06/IAS_Brochure-Nepali.pdf
Journal article	Sharma, L.N, Adhikari, B., Karna, B., Shrestha, B., Paudel, E. (2018). Management of Invasive Species in Community Forest	Nepalese	Nepal	Male	ForestAction Nepal	https://www.forestaction.org/publications/view/251
Journal article	Shrestha, U.B & Shrestha, B.B. (2019). Climate change amplifies plant invasion hotspots in Nepal	Nepalese	Australia	Male	Diversity and Distributions	https://onlinelibrary.wiley.com/doi/epdf/10.1111/ddi.12963
Journal article (submitted)	Sharma, L.N, Adhikari, B, Watson, M.F., Karna, B, Paudel, E., Shrestha, B.B., Rijal, D.P. (2019)	Nepalese	Nepalese	Male	Submitted to Biological Invasion and achieved in	https://www.biorxiv.org/content/10.1101/747287v1

Annex 6 Darwin Contacts

Ref No	23-031
Project Title	Science-based interventions reversing negative impacts of invasive plants in Nepal
Project Leader Details	
Name	Dr Mark F Watson
Role within Darwin Project	Principal Investigator (PI)
Address	
Phone	
Fax/Skype	
Email	
Partner 1	
Name	Mrs. Jaishree Sijapati
Organisation	Nepal Academy of Science and Technology (NAST)
Role within Darwin Project	Co-PI
Address	
Fax/Skype	
Email	
Partner 2	
Name	Dr Birendra Karna
Organisation	ForestAction Nepal
Role within Darwin Project	Team Leader, implementing partner
Address	
Fax/Skype	
Email	
Partner 3	
Name	Dr Bharat Babu Shrestha
Organisation	Central Department of Botany, Tribhuvan University
Role within Darwin Project	TU-CDB , project coordinator (expert in invasion biology)
Address	
Email	