CPC Reintroduction Database – User Handbook

Contents

Background 2

Sources of data 2

Data Harmonization 2

Database and survey format 3

Defining a reintroduction project 3

Eligibility 3

Co-authorship Policy and Database Citation 4

Field Definitions 4

Main submission form 4

Outplanting Event form 14

Monitoring Event form 16

References 19

Background

Sources of data

Before the inception of the web-based reintroduction submission forms, the CPC gathered and standardized reintroduction data from a combination of sources. These included the CPC International Reintroduction Registry (2009), the REDCap Reintroduction Database for US Rare Plants (2018), and new records found in the academic and gray literature and through communication with practitioners.

Efforts by the CPC to collate information on plant reintroduction projects first came to fruition in 2009, when Ed Guerrant presented the CPC International Reintroduction Registry (CPCIRR) (Guerrant 2011). This resource documented 145 reintroduction projects, mainly in the United States, and included at least basic taxonomic, location, management technique, and data source information. It also contained temporally detailed data on outplanting and monitoring events. After excluding projects outside the geographical scope of the new CPC Reintroduction Database (the United States and US territories), 97 reintroductions from the CPCIRR were eligible for inclusion.

The most significant source of data for the CPC Reintroduction Database (CPCRD) originates from efforts by Matthew Albrecht and Oyomoare Osazuwa-Peters at the Missouri Botanical Garden, who created the REDCap Reintroduction Database for US Rare Plants. The database name is derived from the application used to collect the data - REDCap (research electronic data capture) - a secure and freely available web-based program for building and managing online surveys and databases. Their REDCap survey had a total of 66 questions focused on the different stages of a reintroduction, along with information on participants and species traits. After some eligibility screening, a total of 277 reintroductions were retained for inclusion in the REDCap database. Before incorporating the REDCap data into the CPCRD, each participant was contacted to request their permission to include their entries in the CPCRD. The majority of participants granted the CPC permission to access and transfer their records (*n* = 252).

In order to locate more recent plant reintroductions, participants of the CPCIRR and the REDCap survey were also asked if they were involved in any new projects. Those that were received a short data request form focused on obtaining basic information on these new projects. Data from the completed forms contributed to the publicly accessible reintroduction registry (https://saveplants.org/reintroduction-registry/), while also creating a useful starting point for further data entry once the CPCRD and associated forms went live on the website. This approach, along with some opportunistic literature searches, resulted in the cataloguing of 113 new reintroduction projects from across the US.

Data Harmonization

Fields in the CPCRD were chosen based on their potential to support topical research and inform future practice in rare plant reintroductions. While the majority of fields in the CPCRD align with the fields in the REDCap database, around a third are unique. This is why, at the time of going live (October 2022), no project in the database is 100% complete and why contributors are encouraged to fill in gaps where possible. Some of the fields have also been converted from categorical (single or multiple choice questions) to continuous format (free text questions) in order to facilitate future scientific research.

While a source of inspiration for some of the fields in both the REDCap Database and the CPCRD, far fewer of the fields in the CPCIRR overlapped with the new CPCRD. However, the CPCIRR collected data on specific outplanting and monitoring events, allowing a more temporally detailed examination of reintroduction techniques and results. Where available, this information was added to the new outplanting and monitoring event databases.

Database and survey format

For every reintroduction project, the CPCRD collates and standardizes data on up to 51 fields of information, grouped into the following 5 categories:

- Participant information
- Reintroduction project description
- Taxon information and source selection
- Monitoring and management
- Status and performance

The definitions of every field and of every possible response are presented in the Field Definitions section of the handbook. In addition to the main reintroduction project submission form, the CPC also collects information via two event submission forms, one focused on outplanting events and the other on monitoring events. The two event forms consist of a smaller number of fields than the main survey, with some fields explicitly linked to the fields in the original submission, such as the first year reproductive individuals were observed, or the current status and trend of the reintroduced population. These event forms allow practitioners to update their reintroduction project submissions with new information as their project progresses.

Defining a reintroduction project

Before filling out the reintroduction database form, it is important that the contributor considers the CPC's criteria for defining a reintroduction or other form of conservation translocation. The CPC defines a reintroduction or other conservation translocation project as the outplanting of propagules (seeds and/or plants) of a taxon over a single or multiple years at the same site, or in multiple locations within a single site. If a taxon was outplanted at multiple locations or sites, the contributor must decide whether they qualify as a single or separate project. Two rules of thumb are provided to help determine whether separate sites should be considered single or distinct projects:

A. Spatial proximity rule (adapted from NatureServe's 2004 Habitat-based Plant Element Occurrence Delimitation Guidelines) 1. Distinct units that are < 1 km apart should be collapsed into a single reintroduction or other conservation translocation project. 2. Distinct units that are 1 - 10 km apart should be considered single or separate projects depending on the species biology, project goals, and habitat. 3. Distinct units that are > 10 km apart should be considered as separate projects.

B. Experimental treatments rule. Collapse all experimental treatments at a site into a single reintroduction or other conservation translocation project unless they can be considered as separate projects based on the spatial proximity rule above.

Eligibility

The CPCRD focuses on projects in the United States that aimed to establish a viable plant population via translocation, either through the reinforcement of an existing population, or the creation of a new

population. The CPCRD does not include projects where propagules were outplanted purely for experimental purposes, such as reciprocal transplant experiments, common garden experiments, or survival experiments in artificial ecosystems. However, projects with multiple core objectives that include an experimental component are eligible.

The outplanted taxon must be of conservation concern at some scale, whether that be at federal, state, or a more local extent. Translocations that were conducted for commercial purposes, or with no clear conservation-related objective are not eligible.

Co-authorship Policy and Database Citation

If data from the CPCRD is used in a paper or other form of scientific publication, authorship must be offered to all data contributors whose records are included in the analysis, as stated in the Data Usage Policy Agreement. Contact information for a project can be viewed on the read-only version of the relevant web-based entry, or in the "EmailKeyContact" column in the main database download.

The databases should also be acknowledged with the following citation: Center for Plant Conservation. 2022. CPC Reintroduction Database. https://saveplants.org/reintroduction-database/. [Accessed Date].

Field Definitions

The fields in each of the CPC reintroduction forms, along with the field type and selection options, are in green, while the corresponding database column names are in gray. The questions are listed in the order that they appear in each of the submission forms.

Main submission form

1.1 PARTICIPANT INFORMATION

1.1.1 First and last name [free text]

NameKeyContact

1.1.2 Email [free text]

EmailKeyContact

1.1.3 Name of lead institution implementing this reintroduction project [single selection with other]

LeadInstitution, LeadInstitutionOther

1.2 REINTRODUCTION PROJECT DESCRIPTION

1.2.1 Scientific name of reintroduced taxon [free text]

PlantTaxon

The Latin binomial or trinomial name that appears in the database is the one reported by the original contributor. Consequently, there may be a mismatch between the name that appears in the reintroduction database and the name used in other CPC tools.

1.2.2 Major types of institutions/agencies involved in this reintroduction project [multiple selection]

1 Federal Government | 2 State Government | 3 Botanical Garden | 4 University/Research Institute | 5 NGO/Nonprofit | 6 Aboriginal/First Nations/Indigenous group | 7 Corporation | 8 Private individual(s) | 9 Other

ConservationAgencySupport, ConservationAgencySupportOther

1.2.3 Full reference associated with reintroduction project [free text]

FullReference1, FullReference2, FullReference3, FullReference4

1.2.4 Citation [free text]

RefCitation1, RefCitation2, RefCitation3, RefCitation4

1.2.5 DOI or link to reference, if available [free text]

RefLink1, RefLink2, RefLink3, RefLink4

1.2.6 Type of literature [single selection]

1 Scientific paper | 2 Academic thesis | 3 Blog post | 4 Book chapter | 5 Conference material | 6 Government report | 7 Other formal report | 8 Other

RefSourceType1, RefSourceType1Other, RefSourceType2, RefSourceType2Other, RefSourceType3, RefSourceType3Other, RefSourceType4, RefSourceType4Other

1.2.7 USFWS Endangered Species List threat designation at the time of outplanting in the State of reintroduction [single selection]

1 Endangered | 2 Threatened | 3 Not Listed | 4 Unknown

RegionalThreatStatus

1.2.8 What was the NatureServe Global Conservation status of species at time of outplanting? [single selection]

1 G1 | 2 G2 | 3 G3 | 4 G4 | 5 G5 | 6 Unknown

NatureServeGlobalConservationStatus

1.2.9 Why was this taxon chosen for reintroduction? [multiple selection]

1 To reduce extinction risk of a listed threatened, endangered, or candidate species on the Endangered Species Act | 2 To reduce extinction risk of a species of concern at the state or regional level | 3 Experimental | 4 Enhance genetic diversity of an existing population | 5 Mitigation | 6 Cultural value

SpeciesChosenReason

1.2.10 Type of reintroduction project [single selection]

1 Reintroduction -- inside indigenous range to a historically occupied or unoccupied site | 2 Reinforcement – into an existing population of conspecifics | 3 Assisted Colonization -- outside organism's indigenous range to avoid extinction of populations of the focal taxa | 4 Ecological Replacement -- outside organism's indigenous range to perform a specific ecological function | 5 Unknown

ProjectType

1.2.11 Name of recipient site [free text]

SiteName

Due to the rarity of species in the database, there is a risk of poaching or other forms of exploitation. Consequently, the recipient site name is only accessible to the original data contributor, members of their institution and a small number of staff from the CPC Headquarters.

1.2.12 State/Territory within USA where recipient site is located [free text]

StateUSTerritory

1.2.13 Protection status of recipient site [single selection]

1 Public protected | 2 Public non-protected | 3 Private protected | 4 Private non-protected | 5 Mixed landownership | 6 Unknown

SiteType

1.2.14 Which attributes of the recipient site were assessed prior to outplanting? [multiple selection]

1 Soil nutrients | 2 Soil pH | 3 Soil organic matter | 4 Topography | 5 Elevation | 6 Aspect | 7 Hydrology | 8 Geology | 9 Indicator species | 10 Macroclimate | 11 Microclimate | 12 Canopy cover | 13 Canopy height | 14 Ground cover | 15 Photosynthetic photon flux density | 16 Evidence of herbivores | 17 Unknown

SiteAttributesAssessed

1.2.15 Number of subsites [free text]

MultipleSubSites

1.2.16 Latitude and longitude of recipient site [free text]

LocationRecipientSite

Due to the rarity of species in the database, there is a risk of poaching or other forms of exploitation. Consequently, the coordinates of the recipient site are only accessible to the original data contributor, members of their institution and a small number of staff from the CPC Headquarters.

1.2.17 Select a habitat that BEST describes the reintroduction site [single selection]

1 Forest (evergreen, deciduous, mixed) | 2 Upland shrub-land (scrub, chaparral, heath-land) | 3 Savanna & shrub-steppe (glades/outcrops, barrens & open woodland/savanna) | 4 Upland grassland (prairies, meadows, balds) | 5 Woody wetlands/riparian (bog, floodplain forest, swamp, flat-woods) | 6 Herbaceous wetlands (salt/freshwater marsh, vernal pool, fen/seep) | 7 Sparsely vegetated (cliff, dunes, bluffs, beach, and talus) | 8 Unknown

HabitatType

1.2.18 What type(s) of pre- and post-outplanting plans were integrated into the project? [multiple selection]

1 Written reintroduction plan | 2 Written monitoring protocol | 3 Exit strategy, prior to initial outplanting | 4 Exit strategy, post initial outplanting | 5 None | 6 Unknown | 7 Other

PlanningDocumentation, PlanningDocumentationOther

1.2.19 Type of guidance consulted prior to the reintroduction? [multiple selection]

1 IUCN/SSC Reintroduction Guidelines | 2 CPC Best Practices Reintroduction Guidelines | 3 Experts in the field | 4 None | 5 Unknown | 6 Other

GuidanceConsulted, GuidanceConsultedOther

1.2.20 When did the focal taxon become extirpated at the recipient site prior to reintroduction? [single selection]

1 < 1 year | 2 1 - 5 years | 3 6 - 10 years | 4 11 - 20 years | 5 21 - 50 years | 6 51 - 100 years | 7 > 100 years | 8 Not applicable | 9 Unknown

PrereintroductionExtirpationYear

1.2.21 How has climate change influenced management decisions in this reintroduction project? [multiple selection]

1 Selection of recipient site | 2 Selection of source population(s) | 3 Type of propagules outplanted | 4 Pre-outplanting management plan | 5 Post-outplanting management plan | 6 Monitoring approach | 7 No influence | 8 Other

InfluencesClimateChange, InfluenceClimateChangeOther

1.3 TAXON INFORMATION AND SOURCE SELECTION

1.3.1 Life history type of outplanted taxon [single selection]

1 Annual | 2 Biennial | 3 Monocarpic perennial | 4 Polycarpic perennial | 5 Unknown

LifeHistory

1.3.2 Life form of outplanted taxon [single selection]

1 Non vascular (e.g., mosses) | 2 Fern | 3 Graminoid (including grasses, sedges, and rushes) | 4 Forb/herb 5 Liana/vine | 6 Subshrub/suffructicose (low-growing shrub, especially one that is woody only at the base) | 7 Woody Shrub | 8 Tree | 9 Cactus | 10 Unknown

LifeForm

1.3.3 Age at which focal taxon reaches sexual maturity (in years) [free text]

AgeReproductiveMaturity

1.3.4 Number of source populations used in reintroduction project [free text]

Data originating from the REDCap database was collected in categorical format for this field (1 Single | 2 2-5 | 3 6-10 | 4 >10 | 5 Unknown)

DiversitySourcePopulations, DiversitySourcePopulationsCategorical

In the REDCap database, which represented the main source of data prior to the development of the CPC's web-based reintroduction submission forms, this field was categorical. To reflect the likelihood that practitioners will have an exact value for this field and to aid future topical research questions, data for this question is now collected in continuous format.

1.3.5 Why were source populations selected? [multiple selection]

1 No reason | 2 Geographical proximity to reintroduction site | 3 Ecological similarity to reintroduction site | 4 Healthy demographic status (e.g, increasing or stable population growth, large population size, high seed production) | 5 Logistical reasons (e.g., site accessibility, permit constraints) | 6 Genetic considerations (e.g, high genetic variation, reestablish gene flow or connectivity) | 7 Only existing population or material available | 8 Imminent threat to habitat at source location | 9 Experimenting with different source populations | 10 Unknown

SourcePopulationsReason

1.3.6 Collection and propagation of founders [single selection]

1 Maternal lines maintained separately | 2 Bulk collection from multiple plants | 3 Unknown

RelatednessFounders

1.3.7 Latitude and longitude of source population site(s) [free text]

LocationSourcePopulationSites

Due to the rarity of species in the database, there is a risk of poaching or other forms of exploitation. Consequently, the coordinates of the source site(s) are only accessible to the original data contributor, members of their institution and a small number of staff from the CPC Headquarters.

1.3.8 When were propagules outplanted at the recipient site? [multiple selection]

From 1970 to present

YearsOutplanting

1.3.9 Age of oldest propagules outplanted (in years and months) [free text]

MaxAgeFounders

1.3.10 Which type(s) of propagules were outplanted?

- **Seeds** [multiple selection]
  1 seeds - Seeds stored in ex situ collection (dried, frozen, etc.) for > 1 year | 2 seeds - Seeds recently collected or stored in ex situ collection for < 1 year | 3 seeds - Commercial seed supplier | 4 seeds – Unknown

PropaguleTypes

- **Seedlings** [multiple selection]
  5 seedlings - Propagated from seeds stored in ex situ collection for > 1 year | 6 seedlings - Propagated from recently collected or stored for < 1 year | 7 Propagated from vegetative cuttings, root divisions, or etc. | 8 seedlings - Rescued or removed from natural population | 9 seedlings – Unknown
  PropaguleTypes

- **Non-repro adults** [multiple selection]
  10 Non-repro adults from ex situ collection > 1 year | 11 Non-repro adults from ex situ collection < 1 year | 12 Non-repro adults from vegetative cuttings, root divisions, or etc. | 13 Non-repro adults rescued or removed from the wild | 14 Non-repro adults from unknown source
  PropaguleTypes

- **Repro adults** [multiple selection]
  15 Repro adults from ex situ collection > 1 year | 16 Repro adults from ex situ collection < 1 year | 17 Repro adults from vegetative cuttings, root divisions, or etc. | 18 Repro adults rescued or removed from the wild | 19 Repro adults from unknown source | 20 Unknown propagule type
  PropaguleTypes

1.3.11 For each propagule type used in the reintroduction project, add the number of propagules outplanted [free text]

NumberSeedsOutplanted, NumberSeedlingsOutplanted, NumberNonreproAdultsOutplanted, NumberReproAdultsOutplanted, NumberUnknownLifestageOutplanted

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1.4 MONITORING AND MANAGEMENT

1.4.1 Total number of annual monitoring events [free text]

NumberAnnualMonitoringEvents

1.4.2 When was the most recent monitoring event? Please write year and month if known. [free text]

YearLastMonitoringEvent, MonthLastMonitoringEvent

1.4.3 Threats to taxon at the site of reintroduction observed at the time of outplanting [multiple selection]

1 No threats | 2 Residential and commercial development | 3 Agriculture | 4 Energy production/mining | 5 Transportation & service corridors | 6 Biological resource use | 7 Recreational activities | 8 Military exercises | 9 Human intrusion | 10 Fire and fire suppression | 11 Dams and water management use | 12 Ecosystem modification | 13 Invasive non-native/alien species | 14 Problematic native species | 15 Pollution | 16 Geologic events | 17 Climate change | 18 Severe weather | 19 Unknown

ThreatsOutplanting

1.4.5 Threats to taxon observed at the most recent monitoring event [multiple selection]

1 No threats | 2 Residential and commercial development | 3 Agriculture | 4 Energy production/mining | 5 Transportation & service corridors | 6 Biological resource use | 7 Recreational activities | 8 Military exercises | 9 Human intrusion | 10 Fire and fire suppression | 11 Dams and water management use | 12 Ecosystem modification | 13 Invasive non-native/alien species | 14 Problematic native species | 15 Pollution | 16 Geologic events | 17 Climate change | 18 Severe weather | 19 Unknown

ThreatsLastMonitoring

1.4.6 Interventions implemented before/during first outplanting [multiple selection]

1 None | 2 Removal of competing vegetation | 3 Removal of invasive exotics | 4 Herbivore exclusion | 5 Watering/irrigation | 6 Canopy thinning | 7 Prescribed fire | 8 Fire suppression | 9 Soil amendment or nutrient enrichment | 10 Top-soil removal or soil loosening | 11 Microbial inoculation of soils | 12 Disease/pest control | 13 Mowing | 14 Unknown | 15 Other

ManagementInterventionPreOutplanting, ManagementInterventionPreOutplantingOther

1.4.7 Interventions implemented after outplanting [multiple selection]

1 None | 2 Removal of competing vegetation | 3 Removal of invasive exotics | 4 Herbivore exclusion | 5 Watering/irrigation | 6 Canopy thinning | 7 Prescribed fire | 8 Fire suppression | 9 Soil amendment or nutrient enrichment | 10 Top-soil removal or soil loosening | 11 Microbial inoculation of soils | 12 Disease/pest control | 13 Mowing | 14 Unknown | 15 Other

ManagementInterventionPostOutplanting, ManagementInterventionPostOutplantingOther

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1.5 STATUS AND PERFORMANCE

1.5.1 Which year was the taxon last recorded at the site? [free text]

YearLastExtant

1.5.2 What is the current status and trend based on population growth or observed changes in population size? [single selection]

CurrentStatusTrend

1 Extant: stable (i.e., λ ~ 1, or density or frequency changed little since outplanting) | 2 Extant: increasing (i.e., λ > 1, or densities increased since outplanting) | 3 Extant: decreasing (i.e., λ < 1, or densities declined since outplanting) | 4 Extant: too dynamic to estimate trend (i.e., the number of individuals in the population fluctuates widely between monitoring events) | 5 Extant: unknown | 6 Unknown: no longer monitored | 7 Unknown: no longer involved 8 Extinct

1.5.3 How many individuals (across all demographic stages except seeds) were observed at the last monitoring event? [free text]

Data originating from the REDCap database was collected in categorical format for this field (1 0 | 2 1 | 3 2-5 | 4 6-25 | 5 26-50 | 6 51-100 | 7 101-250 |8 251-500 | 9 501-1000 | 10 >1000 | 11 Unknown)

PopulationSizeLastMonitoring, PopulationSizeLastMonitoringEventCategorical

In the REDCap database, which represented the main source of data prior to the development of the CPC's web-based reintroduction submission forms, this field was categorical. To reflect the likelihood that practitioners will have an exact value for this field and to aid future topical research questions, data for this question is now collected in continuous format.

1.5.4 Have reproductive plants been observed in the reintroduced population? [single selection]

1 Yes | 2 No | 3 Unknown

EvidenceReproductiveMaturity

1.5.5 How many reproducing adults were recorded at the last monitoring event? (Previously a categorical field) [free text]

Data originating from the REDCap database was collected in categorical format for this field (1 0 | 2 1 | 3 2-5 | 4 6-25 | 5 26-50 | 6 51-100 | 7 101-250 |8 251-500 | 9 501-1000 | 10 >1000 | 11 Unknown)

NumberReproducingAdultsLastMonitoringEvent,
NumberReproducingAdultsLastMonitoringEventCategorical

In the REDCap database, which represented the main source of data prior to the development of the CPC's web-based reintroduction submission forms, this field was categorical. To reflect the likelihood that practitioners will have an exact value for this field and to aid future topical research questions, data for this question is now collected in continuous format.

1.5.6 When were reproductive plants first observed in outplanted population? [free text]

FirstYearReproductiveMaturityObserved, FirstMonthReproductiveMaturityObserved

1.5.7 Has next generation seedling recruitment been observed in outplanted population? [single selection]

1 Yes | 2 No | 3 Unknown

EvidenceSeedlingRecruitment

1.5.8 When was next gen seedling recruitment first observed in outplanted population? [free text]

FirstYearRecruitmentOccurred, FirstMonthRecruitmentOccurred

1.5.9 Has next generation sexual maturity been observed in outplanted population? [single selection]

1 Yes | 2 No | 3 Unknown

EvidenceNextGenerationMaturity

1.5.10 When was next generation sexual maturity first observed in outplanted population? [free text]

FirstYearNextGenerationMaturityOccurred, FirstMonthNextGenerationMaturityOccurred

1.5.11 What is your perception of the extent of reintroduction success? [multiple selection]

1 Project increased occupancy and species abundance | 2 Project established self sustaining population | 3 Project increased knowledge of species and habitat requirements | 4 Project failed to establish a population | 5 Project was uninformative; no new knowledge gained | 6 Too early in the project to draw conclusions | 7 Unknown | 8 Other

PractitionersPerceptionExtentReintroductionSuccess, PractitionersPerceptionExtentReintroductionSuccessOther

1.5.12 Why do you think this reintroduced population went extinct or performed poorly? [multiple selection]

1 Unsuitable habitat | 2 Unsuitable climate | 3 Improper reintroduction techniques (e.g., planting in the wrong season for species) | 4 Threats at the site; stochastic events (e.g., drought, floods) | 5 Threats at the site; biotic agents (e.g., disease, herbivory) | 6 Threats at the site; improper or lack of habitat management | 7 Threats at the site; others | 8 Unknown | 9 Other | 10 NA

PractitionersPerceptionCauseExtinction, PractitionersPerceptionCauseExtinctionOther

Outplanting Event form

2.1 TAXON INFORMATION AND SOURCE SELECTION

2.1.1 Month of outplanting event [single selection]

1 January | 2 February | 3 March | 4 April | 5 May | 6 June | 7 July | 8 August | 9 September | 10 October | 11 November | 12 December

OutplantingMonth

2.1.2 Year of outplanting event [free text]

From 1970 to present

OutplantingYear

2.1.3 Source population(s) the same as in previously submitted data? [single selection]

1 Yes | 2 No

OutplantingSameSource

2.1.4 Number of new source populations in this outplanting event [free text]

OutplantingSourceDiversity

2.1.5 Why were source populations selected? [multiple selection]

1 No reason | 2 Geographical proximity to reintroduction site | 3 Ecological similarity to reintroduction site | 4 Healthy demographic status (e.g, increasing or stable population growth, large population size,

high seed production) | 5 Logistical reasons (e.g., site accessibility, permit constraints) | 6 Genetic considerations (e.g, high genetic variation, reestablish gene flow or connectivity) | 7 Only existing population or material available | 8 Imminent threat to habitat at source location | 9 Experimenting with different source populations | 10 Unknown

OutplantingSourceReason

2.1.6 Collection and propagation of founders [multiple selection]

1 Maternal lines maintained separately | 2 Bulk collection from multiple plants | 3 Unknown

OutplantingSourceRelatedness

2.1.7 Latitude and longitude of source population site(s) used in this outplanting event [free text]

OutplantingSourceLocation

2.1.8 Which type(s) of propagules were outplanted in this outplanting event?

- **Seeds** [multiple selection]
  1 seeds - Seeds stored in ex situ collection (dried, frozen, etc.) for > 1 year | 2 seeds - Seeds recently collected or stored in ex situ collection for < 1 year | 3 seeds - Commercial seed supplier | 4 seeds – Unknown
  PropaguleTypes

- **Seedlings** [multiple selection]
  5 seedlings - Propagated from seeds stored in ex situ collection for > 1 year | 6 seedlings - Propagated from recently collected or stored for < 1 year | 7 Propagated from vegetative cuttings, root divisions, or etc. | 8 seedlings - Rescued or removed from natural population | 9 seedlings – Unknown
  PropaguleTypes

- **Non-repro adults** [multiple selection]
  10 Non-repro adults from ex situ collection > 1 year | 11 Non-repro adults from ex situ collection < 1 year | 12 Non-repro adults from vegetative cuttings, root divisions, or etc. | 13 Non-repro adults rescued or removed from the wild | 14 Non-repro adults from unknown source
  PropaguleTypes

- **Repro adults** [multiple selection]
  15 Repro adults from ex situ collection > 1 year | 16 Repro adults from ex situ collection < 1 year | 17 Repro adults from vegetative cuttings, root divisions, or etc. | 18 Repro adults rescued or removed from the wild | 19 Repro adults from unknown source | 20 Unknown propagule type
  PropaguleTypes

2.1.9 For each propagule type used in reintroduction project, number of propagules outplanted [free text]

OutplantingNumberSeeds, OutplantingNumberSeedlings, OutplantingNumberAdultsNonrepro, OutplantingNumberAdultsRepro, OutplantingNumberUnknownLifestage

2.1.10 Age of oldest propagules outplanted (in years and months) [free text]

OutplantingMaxAge

Monitoring Event form

3.1 MONITORING AND MANAGEMENT

3.1.1 Month of monitoring event [single selection]

1 January | 2 February | 3 March | 4 April | 5 May | 6 June | 7 July | 8 August | 9 September | 10 October | 11 November | 12 December

MonitoringMonth

3.1.2 Year of monitoring event [free text]

From 1970 to present

MonitoringYear

3.1.3 Threats to taxon observed during monitoring event [multiple selection]

1 No threats | 2 Residential and commercial development | 3 Agriculture | 4 Energy production/mining | 5 Transportation & service corridors | 6 Biological resource use | 7 Recreational activities | 8 Military exercises | 9 Human intrusion | 10 Fire and fire suppression | 11 Dams and water management use | 12 Ecosystem modification | 13 Invasive non-native/alien species | 14 Problematic native species | 15 Pollution | 16 Geologic events | 17 Climate change | 18 Severe weather | 19 Unknown

NewThreatsMonitoringEvent

3.1.4 Interventions implemented since previous monitoring update [multiple selection]

1 None | 2 Removal of competing vegetation | 3 Removal of invasive exotics | 4 Herbivore exclusion | 5 Watering/irrigation | 6 Canopy thinning | 7 Prescribed fire | 8 Fire suppression | 9 Soil amendment

or nutrient enrichment | 10 Top-soil removal or soil loosening | 11 Microbial inoculation of soils | 12 Disease/pest control | 13 Mowing | 14 Unknown | 15 Other

ManagementIntervention, ManagementInterventionOther

3.2 STATUS AND PERFORMANCE

3.2.1 Year taxon was last recorded at the site? [free text]

YearLastExtant

3.2.2 Change in status and trend since outplanting [single selection]

1 Extant: stable (i.e., λ ~ 1, or density or frequency changed little since outplanting) | 2 Extant: increasing (i.e., λ > 1, or densities increased since outplanting) | 3 Extant: decreasing (i.e., λ < 1, or densities declined since outplanting) | 4 Extant: too dynamic to estimate trend (i.e., the number of individuals in the population fluctuates widely between monitoring events) | 5 Extant: unknown | 6 Unknown: no longer monitored | 7 Unknown: no longer involved 8 Extinct

StatusTrendChangeOutplanting

3.2.3 Change in status and trend since previous submission [single selection]

1 Extant: stable (i.e., λ ~ 1, or density or frequency changed little since outplanting) | 2 Extant: increasing (i.e., λ > 1, or densities increased since outplanting) | 3 Extant: decreasing (i.e., λ < 1, or densities declined since outplanting) | 4 Extant: too dynamic to estimate trend (i.e., the number of individuals in the population fluctuates widely between monitoring events) | 5 Extant: unknown | 6 Unknown: no longer monitored | 7 Unknown: no longer involved 8 Extinct

StatusTrendChangePreviousSubmission

3.2.4 Total number of individuals (across all demographic stages except seeds) recorded [free text]

PopulationSizeLastMonitoringEvent

3.2.5 How many reproducing adults were recorded at this monitoring event? [free text]

NumberReproducingAdultsLastMonitoringEvent

3.2.6 When were reproductive plants first observed in outplanted population? [free text]

FirstYearReproductiveMaturityObserved, FirstMonthReproductiveMaturityObserved

3.2.7 Were next generation seedlings recorded at this monitoring event? [single selection]

1 Yes | 2 No | 3 Unknown

NextGenerationSeedlingsPresent

3.2.8 When was next gen seedling recruitment first observed in outplanted population? [free text]

FirstYearNextGenerationRecruitmentOccurred, FirstMonthNextGenerationRecruitmentOccurred

3.2.9 Were next gen reproductive individuals recorded at this monitoring event? [single selection]

1 Yes | 2 No | 3 Unknown

EvidenceNextGenerationMaturityMonitoring

3.2.10 When was next gen sexual maturity first observed in outplanted population? [free text]

FirstYearNextGenerationMaturityOccurred, FirstMonthNextGenerationMaturityOccurred

3.2.11 Has your perception of the extent of reintroduction success changed since the most recent submission? [single selection]

1 Yes | 2 No

ChangePerceptionSuccess

3.2.12 What is your perception of the extent of reintroduction success? [multiple selection]

1 Project increased occupancy and species abundance | 2 Project established self sustaining population | 3 Project increased knowledge of species and habitat requirements | 4 Project failed to establish a population | 5 Project was uninformative; no new knowledge gained | 6 Too early in the project to draw conclusions | 7 Unknown | 8 Other

PerceptionExtentReintroductionSuccessMonitoring, PerceptionExtentReintroductionSuccessMonitoringOther

3.2.13 Why do you think this reintroduced population went extinct or performed poorly? [multiple selection]

1 Unsuitable habitat | 2 Unsuitable climate | 3 Improper reintroduction techniques (e.g., planting in the wrong season for species) | 4 Threats at the site; stochastic events (e.g., drought, floods) | 5 Threats at the site; biotic agents (e.g., disease, herbivory) | 6 Threats at the site; improper or lack of habitat management | 7 Threats at the site; others | 8 Unknown | 9 Other | 10 NA

PerceptionCauseExtinctionMonitoring, PerceptionCauseExtinctionMonitoringOther

References

Albrecht, M. & Osazuwa-Peters, O. 2018. REDCap Reintroduction Database for US Rare Plants. Missouri Botanical Garden.

Guerrant, E.O. Jr., 2011. Characterizing two decades of rare plant reintroductions, In Plant reintroduction in a changing climate: promises and perils. eds J. Maschinski, K.E. Haskins. Island Press, Washington DC.