

BPA Semi-Annual Call for Proposals: Imperiled and Invasive Species

The Biodiversity Protection Association (BPA) is a (fictional) non-profit agency dedicated to advancing basic scientific knowledge that is relevant to preserving Earth's biodiversity. This year, the BPA will fund a limited number of collaborative research projects focused on imperiled (threatened or endangered) or invasive species.

Collaborating scientists will form a "working group" focused on a single imperiled or invasive species. Each working group will first work together to identify research priorities for its focal species. Each collaborator will then independently design his or her own experiment and submit an **independent written research proposal** to address one of the research priorities.

At the time of funding decisions, each working group will also summarize its collaborative research program in an **oral presentation during the semi-annual BPA symposium**. Peer review of oral presentations at the symposium will help to determine the order of priority for funding projects. Final funding decisions will be made by the program officer, based on the scientific merit and relevance of the proposal to BPA's goals.

BPA has minimum criteria for funding. To be considered for funding, projects must be:

- **Definitive** – The proposal should identify a critical prediction of the research question and describe an experiment to produce data that will directly address the critical prediction. The experiment must be carefully designed, leading to confidence in the results.
- **Feasible** – The experiment must be described in sufficient detail to demonstrate that the research can be completed within a reasonable timeframe and budget, that it will lead to an interpretable result, and that it will follow ethical guidelines.
- **Significant** – The new knowledge gained from the experiment should be significant in advancing the ability of biologists to either maintain viable populations of an imperiled organism or to limit ecological devastation from an invasive species.

Preparing a BPA proposal (Note: WG = working group, IC = individual collaborator)

Step 1: Identify potential focal species. Each working group (WG) will select and rank four invasive or imperiled species from the candidate list. The working group will be assigned a species, based on its preferences. One representative of each working group must submit the group's collective preferences **by email by noon on the day before the next recitation**.

Recitation (week 1): WGs convene

Follow-up: WG researches potential focal species, submits four preferences

Step 2: Conduct background research. With your working group, carefully research the primary literature to determine what is known about biological problems involving your species. For imperiled species: what are the threats to their long-term survival, and why are they vulnerable to these threats? For invasive species: why have they become invasive, and what problems are they causing? In either case, what approaches have previous researchers taken to understanding the source of the problems? What questions have been answered scientifically, and what remain to be answered? You must first become an expert on the species and its problems to determine priorities for future research. One representative of each working group must submit the group's annotated bibliography **by email by noon on the day before next recitation**. The annotated bibliography should contain 16-20 references.

Recitation (week 2): literature database tutorial

*Follow-up: WG does literature review, generates annotated bibliography; ICs begin outlining **introduction/background** section of proposal*

Step 3.1: Identify research priorities for the focal species. Each working group (WG) should identify a set of problems involving its focal species that have not yet been addressed adequately in the scientific literature. As your group works to prioritize and refine questions for scientific study, return to the primary literature to verify that each question can be addressed scientifically, that the answer will contribute significantly to addressing an important problem, and that the question has not been answered by previous studies.

Step 3.2: Design your own experiment. Each individual collaborator (IC) should identify a unique experimental approach to one of the group's top questions. Experiments within each group should be distinct from one another and from previously published research (the primary literature should be consulted again for verification). Groups collectively share the responsibility for making sure that each member is designing a different experiment. Each IC should submit an experimental design worksheet **by lecture on the day before recitation the following week**.

Recitation (week 3): WG decides on research priorities and divides research questions among ICs; initial discussion of experimental design

*Follow-up: ICs identify a critical prediction of research question and complete preliminary experimental design worksheet; read article and complete article worksheet; begin outlining **significance** section of proposal*

Step 4: Refine experimental design. ICs meet with WGs to gain feedback on their critical predictions and experimental designs. As ICs refine the specifics of the experimental design, they should also return to the primary literature to gather the detailed information needed to formulate a *feasible, definitive, and significant* project. Each IC should submit an independent pre-proposal **by noon three days before this recitation**. Each IC should bring and submit *four* copies of a rough draft of *possible results* and *significance* sections **at the beginning of recitation**.

Recitation (week 4): discussion of experimental design; ICs gain feedback from WGs

*Follow-up: ICs consult literature, complete and submit independent pre-proposal; begin outlining **proposed research** and **possible results** sections of proposal*

Step 5: Finish writing your own proposal. It is highly recommended that each IC begin writing his or her own research proposal as early as possible. The writing should strive for clarity, precision, and an economy of language (*make every word count*). Your proposal will be graded for *content*, not length. Most proposals will require from 4 to 6 pages of well-written text, not including figures and literature cited, to provide the information and logical steps necessary to meet the following goals:

- a) present background information needed to understand the broader context and conservation issues relevant to your focal species
- b) justify the need for addressing the particular research problem, and define the research question to be answered
- c) describe a well-designed experiment that will directly address the research question
- d) describe possible outcomes of your experiment and how you would interpret them
- e) explain the significance of your proposed research in a larger context

Specific guidelines for sections of the proposal will be provided in a separate announcement.

Candidate invasive or imperiled species

(each group submits 4 preferences, no more than 2 from any group)

Invasive species

Terrestrial invertebrates

- Asian lady beetle (*Harmonia axyridis*)
- red imported fire ant (*Solenopsis invicta*)
- gypsy moth (*Lymantria dispar*)
- hemlock woolly adelgid (*Adelges tsugae*)
- Asian long-horn beetles (*Anoplophora glabripennis*)
- thistle weevil (*Rhinocyllus conicus*)
- emerald ash borer (*Agrilus planipennis*)
- glassy-winged sharpshooter (*Homalodisca* spp.)

Terrestrial plants

- kudzu (*Pueraria montana*)
- purple loosestrife (*Lythrum salicaria*)
- bush honeysuckle (*Lonicera* spp.)
- cogongrass (*Imperata cylindrica*)

Vertebrates

- sea lamprey in Great Lakes (*Petromyzon marinus*)
- brown tree snake (*Boiga irregularis*)
- cane toads in Australia (*Bufo marinus*)
- bullfrogs in western US (*Rana catesbiana*)

Fungi

- Dutch elm disease (*Ophiostoma ulmi*)
- amphibian chytrid fungus (*Batrachochytrium dendrobatidis*)

Aquatic invertebrates

- Asian clam (*Corbicula fluminea*)
- green mussel (*Perna viridis*)
- green crab (*Carcinus maenas*)
- tunicate (*Styela clava*)
- northern Pacific sea star (*Asterias amurensis*)
- Chinese mitten Crab (*Eriocheir sinensis*)
- New Zealand mud snail (*Potamopyrgus antipodarum*)
- veined rapa whelk (*Rapana venosa*)
- rusty crayfish (*Orconectes rusticus*)

Aquatic Plants

- smooth cordgrass (*Spartina alterniflora*)
- water hyacinth (*Eichhornia crassipes*)
- waterweed (*Hydrilla verticillata*)
- Eurasian watermilfoil (*Myriophyllum spicatum*)
- Water Chestnut (*Trapa natans*)
- giant salvinia (*Salvinia molesta*)
- common reed (*Phragmites australis*)
- giant reed (*Arundo donax*)

Imperiled species

Terrestrial invertebrates

- American burying beetle (*Nicrophorus americanus*)
- European blue butterfly (*Maculinea arion*)
- Karner blue butterfly (*Lycaeides melissa*)
- regal fritillary butterfly (*Speyeria idalia*)
- bay checkerspot butterfly (*Euphydryas editha bayensis*)

Vertebrates

- piping plover (*Charadrius melodus*)
- gopher tortoise (*Gopherus polyphemus*)
- mountain yellow-legged frog (*Rana muscosa*)
- California tiger salamander (*Ambystoma californiense*)
- Stephens' kangaroo rat (*Dipodomys stephensi*)
- tidewater goby (*Eucyclogobius newberryi*)
- humpback chub (*Gila cypha*)

Aquatic invertebrates

- white abalone (*Haliotis sorenseni*)
- queen conch (*Strombus gigas*)
- staghorn coral (*Acropora cervicornis*) or elkhorn coral (*Acropora palmata*)
- dwarf wedgemussel (*Alasmidonta heterodon*) and other unionid mussels of the Great Lakes

Plants and lichens

- sea beach amararanth (*Amaranthus pumilus*)
- Torrey pine (*Pinus torreyana*)
- Johnson's seagrass (*Halophila johnsonii*)
- slickspot peppergrass (*Lepidium papilliferum*)
- red 'ilima (*Abutilon menziesii*)
- Florida perforate lichen (*Cladonia perforata*)
- rock gnome lichen (*Gymnoderma lineare*)