Implementation Plan for Integrated Digitized Biocollections (iDigBio)

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1. PROJECT DEFINITION

1.1 Overview

Integrated Digitized Biocollections (iDigBio) is the national coordinating center for the Advancing Digitization of Biodiversity Collections (ADBC) program funded by the U.S. National Science Foundation (NSF). iDigBio is enabling digitization of data and media for millions of biodiversity specimens from U.S. collections and is integrating those data to make them available online for the research community, government agencies, students, educators, citizen scientists, and the general public to promote understanding of biodiversity and societal consequences of environmental issues.

1.2 Vision

The vision for ADBC is a permanent repository of digitized information from all U.S. biodiversity collections that leads to new discoveries through research and a better understanding and appreciation of biodiversity through improved outreach, which then leads to improved environmental and economic policies. Creation of the permanent digitized repository is occurring in four stages:

1. An initial stage where the effort to digitize U.S. biodiversity collections is catalyzed by funding from NSF and enabled by iDigBio activities that foster collaborations, identify priorities, demonstrate the value of biodiversity and collections, and generate information on best practices related to standards, workflows, and data management.

2. An intermediate stage where digitization at Thematic Collections Networks (TCNs), Partners to Existing Networks (PENs), and other participating institutions/networks improves methods and strategies and demonstrates the scientific and societal benefits of validated and readily accessible data.

3. A third stage in which the vision for ADBC is realized through participation by all U.S. institutions with biodiversity collections.

4. A fourth stage in which digitization is a routine and sustained practice in all institutions with biodiversity collections, and the national database is easily accessible as an up-to-date source of information on biodiversity.

1.3 Mission

The mission of iDigBio is to develop a national infrastructure that supports the vision of ADBC by overseeing implementation of standards and best practices for digitization; building and deploying a customized cloud computing environment for collections; recruiting and training personnel, including underserved groups; engaging the research community, collections community, citizen scientists, and the general public through outreach activities; and planning for long-term sustainability of the national digitization effort.

1.4 Horizon

iDigBio is enabling digitization of data from all U.S. biodiversity collections and is integrating those data to make them broadly available and useful with shared standards and formats. Ultimately, ADBC is furthering the discovery and understanding of biodiversity, and iDigBio is engaging the research and collections communities in a spirit of collaboration in an effort to open biodiversity research collections to new downstream user communities.

iDigBio involves the development of a permanent and powerful cloud computing infrastructure to link biodiversity data from collections across the U.S. into a single unified web interface, overcoming the "data silos" that exist across the country. Search and analytical tools enable users to mine diverse data including taxonomy, geographic location, 2- and 3-dimensional images, vocalizations, and molecular resources tied to specimens in collections. These data promote integrative biodiversity research on living and fossil species and provide an immense resource for agricultural science and land use management, human health, and assessing the impacts of climate change, invasive species, and other natural resource management issues.

Key partners in this effort are the Thematic Collections Networks (TCNs), which form a national grid of institutions that are digitizing specimens and associated resources. Integration with the greater community of biocollections resources, tools and organizations is critical to accomplishing the grand challenge of digitizing and integrating data from all U.S. collections, large and small. For more details regarding the larger community that encapsulates ADBC, please refer to the Network Integrated Biocollections Alliance (NIBA) strategic plan and implementation plan.

1.5 Scope

iDigBio is the national resource for digitized information about vouchered natural history collections within the context established by the NIBA community strategic plan and is supported through funds from the NSF ADBC program. As such, iDigBio serves as the coordinating center for the national digitization effort; fosters partnerships and innovations; facilitates the determination and dissemination of digitization practices and workflows; establishes integration and interconnectivity among the data generated by collection digitization projects; and promotes the uses of biodiversity collections data by the scientific community and stakeholders including government agencies, educational institutions, non-governmental organizations (NGOs), and other national and international entities to benefit science and society through enhanced research and outreach activities. iDigBio provides these services to all stakeholders with clarity, simplicity, transparency, intuitive methodology, and intuitive design.

1.5.1 Scope Inclusions

To accomplish these objectives, iDigBio is responsible for the following in-scope activities:

1) Implement a scalable and secure cloud-based infrastructure and web portal to enable the storage, integration, search, and retrieval of existing biodiversity specimen data, images, and other media files contributed by Thematic Collections Networks, other networks, resources, and collaborating institutions.

2) Deliver appliances that integrate and package existing digitization technologies in a manner that enhances and/or simplifies the user experience. Appliances are intended to improve the deployment and interoperability of digitization tools, and to simplify integration with the iDigBio specimen database and storage infrastructure.

3) Provide user services to support interaction with both specimen databases and with appliances. User services will support both data/appliance contributors and data/appliance consumers. User services are provided in the form of a ticket submission and tracking system for requests and problems, telephone support, email support, user documentation, and site visits.

4) Research, evaluate, benchmark, integrate, and disseminate digitization methodologies, end-to-end processes, tools, recommended standards, and workflows that improve the efficiency and scalability of digitization.

5) Provide user services to support efficient, scalable and effective digitization of specimen images, media, and specimen data. User services are provided in the form of a ticket submission and tracking system for requests and problems, telephone support, email support, user documentation, and site visits.

6) Coordinate and fund workshops and working groups to:

    a. Foster partnerships and collaboration within the collections community, as well as to connect to stakeholder organizations external to the collections community.

    b. Conduct training related to digitization, technology, workflows, and other applicable fields.

    c. Recommend standards, common practices, guidelines, workflows, and optimal digitization tools and software for use by ADBC participants.

    d. Foster innovation related to biodiversity collections digitization (including imaging). The outputs of these innovation workshop sessions may include:

        i. Specific application and/or hardware development requirements that are assigned to existing organizations funded for, and tasked with, tool development.

        ii. Documentation of challenges and proposed solutions that may lead to proposals to obtain funding for separate projects to deliver required technologies.

        iii. Creation or improvement of digitization and databasing tools resulting from “hackathons”. These sessions bring together skilled session participants to deliver a specific functional product during the

workshop. Tools created in "hackathons" must be delivered with strategies for maintenance and sustainability.

7) Facilitate the development of standards for digitization, technology, and process training.

8) Coordinate and execute iDigBio outreach activities. Provide advice to and coordination with other digitization projects regarding the integration of outreach activities.

9) Provide opportunities and technologies that encourage communication, collaboration and status reporting among members of the ADBC community.

10) Oversee development of a plan to accomplish digitization of existing biodiversity collections in the US, and establish the long-term sustainability of the ADBC data and related infrastructure, and for iDigBio user services operations.

11) Establish an iDigBio Internal Advisory Committee (IAC) that meets regularly to report on progress in digitization efforts, share and identify best practices and standards, identify gaps in digitization areas and technology, and enhance training efforts. Also establish an External Advisory Board that meets annually to provide advice regarding project activities, the integration of digitization projects, research, outreach activities, strategic direction, and management policies.

12) Track research outcomes, the results of outreach activities, and innovative discoveries related to the project.

1.5.2 Scope Exclusions

To reduce uncertainty in the scope of iDigBio's mission and to prevent scope creep as project requirements are evaluated, the following activities are defined as out-of-scope for iDigBio:

1) Direct development of new tools (hardware or software), or improvements to existing software tools intended to enhance the digitization of existing, vouchered biodiversity collections. iDigBio is not funded or staffed to execute hardware or software development; exceptions are the creation and maintenance of the core iDigBio.org website, the portal/database designed to integrate digitized specimen data, and appliances that integrate with existing tools that support digitization.

2) Specimens collected outside the United States but housed within a US collection/location are within scope as are specimens of interest to US scientists housed in foreign institutions. Federally owned collections will be integrated with iDigBio through GBIF, the Global Biodiversity Information Facility, and BISON, the federal data center.

3) Occurrence records and media not supported by vouchered specimens (e.g., bird sightings without a collected specimen) will not be included in the iDigBio collections

integration portal. However, as other resources for these data are established, appropriate links will be created.

4) iDigBio is not responsible for the acquisition, data curation/management, and quality control of data provided by TCNs and other collaborating collections. However, as part of the execution of in-scope Activity #1 and Activity #2, iDigBio will endeavor to provide tools, features, error-checking, historical record tracking, and feedback mechanisms designed to simplify data curation/management, fitness for use tracking, and quality control by TCNs and other contributing institutions.

1.6 Key Assumptions/Constraints

- Although the project award is for 5 years (July 2011 thru June 2016), the planning horizon for the project will be 10 years (July 2011 thru June 2021). This assumes the award will be renewed for an additional 5 years beyond the original 5-year award.
- All project activities must comply with the terms and conditions of Cooperative Agreement EF-1115210, including the incorporated Financial/Administrative Terms and Conditions (FATC) and Programmatic Terms and Conditions (PTC).
- All project activities must comply with the policies and procedures of the University of Florida and Florida State University, as applicable.

1.7 Key Outcomes

- The primary goal of iDigBio is to create a national collections resource that will integrate critical information for scientific research to aid in understanding the dimensions of biodiversity and societal consequences of global change.
- iDigBio will serve as the central coordinating center for the national digitization effort, foster partnerships, facilitate best practices and workflows, and establish interconnectivity among digitization projects.
- iDigBio will enable links with other digitization projects nationally and internationally.
- iDigBio will establish a plan for long-term preservation of digital data through partnerships with appropriate cyberinfrastructure resources.
- iDigBio will promote and coordinate outreach efforts to a diverse group od stakeholders.

2. STRUCTURE

2.1 Organization

The iDigBio project is organized into five domains to achieve its goals: (1) Project Administration & Management, (2) Education & Outreach, (3) Serving the Research Community, (4) Digitization, and (5) Cyberinfrastructure. The Principal Investigators (PIs) provide leadership within each domain, and the Project Director and Project Manager provide overall leadership for the project.

(1) **Project Administration & Management** – Led by Dr. Larry Page, iDigBio Project Director, and David Jennings, iDigBio Project Manager, both of whom are based at the University of Florida's Florida Museum of Natural History (FLMNH).

(2) **Education & Outreach** – Led by Dr. Bruce MacFadden, iDigBio co-PI, who is based at the University of Florida's Florida Museum of Natural History (FLMNH).

- A product and outgrowth of the Education & Outreach domain is the series of Citizen Science initiatives led by Dr. Austin Mast.

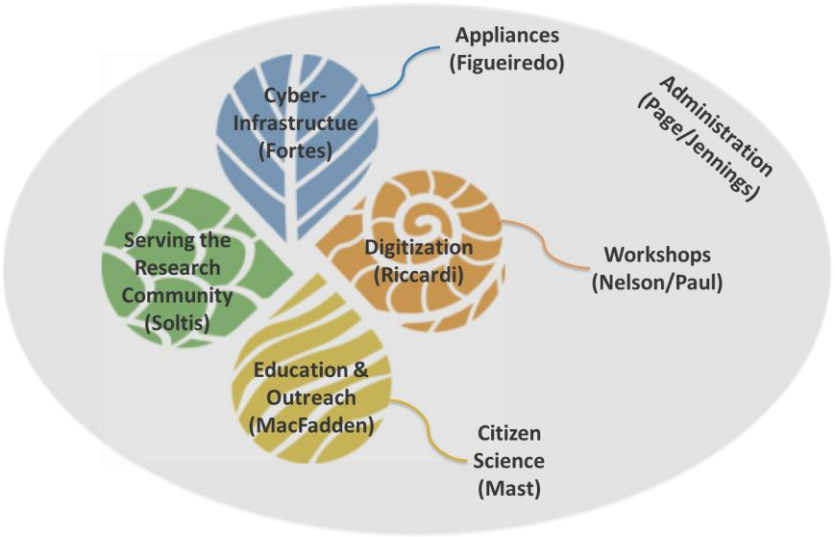
(3) **Serving the Research Community** – Led by Dr. Pamela Soltis, iDigBio co-PI, who is based at the University of Florida's Florida Museum of Natural History (FLMNH).

(4) **Digitization** – Led by Dr. Greg Riccardi, iDigBio co-PI, who is based at Florida State University's Institute for Digital Information and Scientific Communication (iDigInfo).

- A product and outgrowth of the digitization domain is a series of workshops, symposia, and other events conducted throughout each year, the bulk of which are led by Dr. Gil Nelson and Deb Paul.

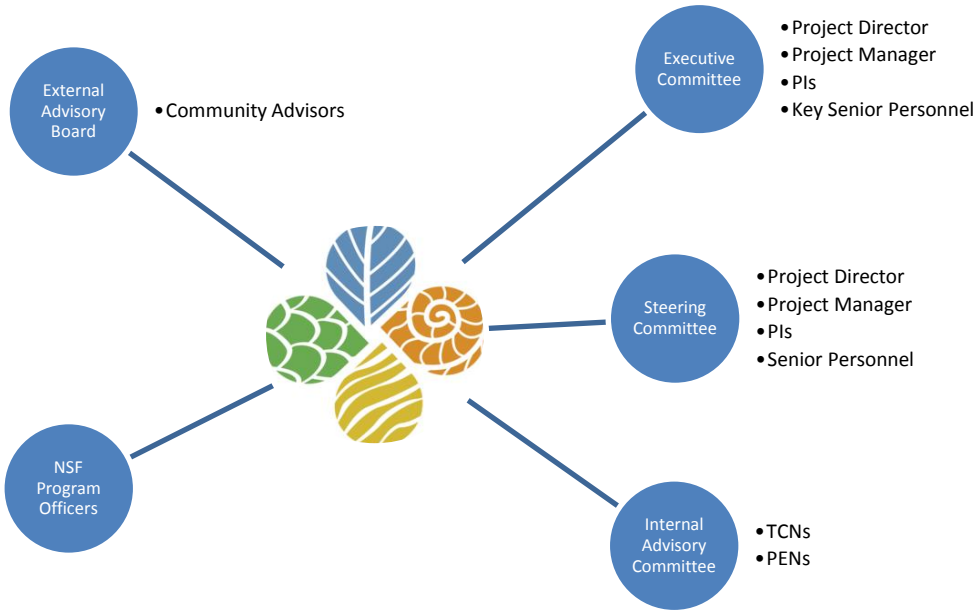
(5) **Cyberinfrastructure** – Led by Dr. José Fortes, iDigBio co-PI, who is based at the University of Florida's Advanced Computing and Information Systems (ACIS) laboratory.

- A product and outgrowth of the Cyberinfrastructure domain is the series of Appliances being developed under the direction of Dr. Renato Figueiredo.



2.2 Project Governance

The project incorporates several oversight committees to provide governance, advice, and leadership concerning goals, strategies, implementation, activities, and progress. The Project Director, in consultation with the Project Manager, Executive Committee, and Steering Committee, makes project decisions that affect scope, budget, and/or risk. The Project Manager effects day-to-day planning, execution, and decision-making.



2.2.1 Executive Committee

The Executive Committee (EC) is composed of the iDigBio Project Director, Principal Investigators, Project Manager, and key Senior Personnel. The Executive Committee is responsible for overall project management, general oversight of iDigBio activities, managing conflicts of interest, and implementation of the strategic plan, including assurance that the digitization, research, training, and outreach missions of iDigBio are integrated and accomplished.

2.2.2 Steering Committee

The Steering Committee (SC) is composed of the iDigBio Project Director, Principal Investigators, Project Manager, and Senior Personnel. The Steering Committee is responsible for reviewing progress and coordinating activities in digitization, research, training, and outreach at iDigBio, and for advising others in iDigBio on overall resource allocation, strategic directions, and

management policies. Minutes from SC meetings are stored in Redmine for internal transparency with the broader project team.

2.2.3 Internal Advisory Committee

The Internal Advisory Committee (IAC) is composed of the Project Manager, Biodiversity Informatics Manager, and representatives from the Thematic Collections Networks (TCNs) and Partners to Existing Networks (PENs). The IAC meets regularly to report on progress in digitization efforts, share and identify best practices and standards, identify gaps in digitization areas and technology, and enhance training efforts. A listing of current IAC members, minutes from past meetings, and copies of TCN reports to iDigBio are available on the iDigBio website: https://www.idigbio.org/wiki/index.php/Internal_Advisory_Committee

2.2.4 External Advisory Board

The External Advisory Board (EAB) is composed of members selected by iDigBio and approved by the NSF program officer. The EAB meets annually and is responsible for advising iDigBio on its strategic directions, management policies, and activities, including progress and integration of digitization projects, research, training, and outreach activities among all funded institutions. A listing of current EAB members and minutes from past meetings are available on the iDigBio website: https://www.idigbio.org/wiki/index.php/IDigBio_External_Advisory_Board

2.3 Project Personnel

Project team members are responsible for the execution of project activities; project leaders serve as activity approvers. Project team members are responsible for involving and consulting internal and external stakeholders regarding project activities. Core project team members are provided in the following table. A full listing of iDigBio staff along with biographies, roles, and responsibilities is available on the iDigBio website: https://www.idigbio.org/content/directory

Name	iDigBio Title/Role	EC	SC	IAC	EAB	Email
Larry Page	Project Director	✓	✓	✓	✓	lpage@flmnh.ufl.edu
Bruce MacFadden	Co-PI (E&O)	✓	✓	✓	✓	bmacfadd@flmnh.ufl.edu
Pam Soltis	Co-PI (Research)	✓	✓	✓	✓	psoltis@flmnh.ufl.edu
Greg Riccardi	Co-PI (Digitization)	✓	✓	✓	✓	griccardi@fsu.edu
José Fortes	Co-PI (Cyberinfrastructure)	✓	✓	✓	✓	fortes@acis.ufl.edu
David Jennings	Project Manager	✓	✓	✓	✓	djennings@flmnh.ufl.edu
Joanna McCaffrey	Biodiversity Informatics Manager		✓	✓		jmccaffrey@flmnh.ufl.edu
Cathy Bester	Project Assistant					cbester@flmnh.ufl.edu
Kevin Love	IT Expert			✓		klove@flmnh.ufl.edu
Molly Phillips	Information Specialist			✓		mphillips@flmnh.ufl.edu
Renato Figueiredo	Appliance Development		✓			renato@acis.ufl.edu
Shari Ellis	Project Evaluator		✓	✓	✓	sellis@ufl.edu
Betty Dunckel	Center for Science Learning		✓			bdunckel@flmnh.ufl.edu
Austin Mast	Citizen Science	✓				amast@bio.fsu.edu
Gil Nelson	Digitization Process Specialist		✓	✓		gnelson@bio.fsu.edu
Alex Thompson	IT Expert					godfoder@acis.ufl.edu
Andréa Matsunaga	Research Scientist			✓		ammatsun@acis.ufl.edu

Name	iDigBio Title/Role	EC	SC	IAC	EAB	Email
Matt Collins	IT Expert					mcollins@acis.ufl.edu
Greg Traub	IT Expert					gtraub@acis.ufl.edu
Deb Paul	Informatics Analyst		✓	✓		dpaul@fsu.edu
Marcia Mardis	Research & Evaluation					marcia.mardis@cci.fsu.edu

2.4 Internal Stakeholders

- University of Florida
  - Florida Museum of Natural History
  - Advanced Computing and Information Systems laboratory
- Florida State University
  - Institute for Digital Information and Scientific Communication
- iDigBio Working Groups and Interest Groups: https://www.idigbio.org/wiki/index.php/IDigBio_Working_Groups

2.5 External Stakeholders

- National Science Foundation
- External Advisory Board
- TCNs and PENs
  - Internal Advisory Committee
- Other data collections/networks (GBIF, ALA, VertNet, etc.)
- Natural history collections
- Data providers
- Users of iDigBio data
- Downstream Users

3. APPROACH

3.1 Strategy

A core group of project leaders, staff, students, and internal stakeholders are responsible for delivering the high-level actions within each of the five project domains. Definitions for the roles and responsibilities in each section are:

- ***Responsible*** for execution of the activity and fostering timely group progress
- ***Approver*** for the activity, confirms successful completion, and makes final decisions
- ***Consulted*** during execution of the activity, contributes information, and provides input
- ***Informed*** about activity progress and decisions

3.1.1 Project Administration & Management

The Project Administration & Management domain provides administrative and logistical support to the other project domains and ensures that activities are coordinated within and across iDigBio domains and with collaborative organizations as appropriate. The key objectives of the Project Administration & Management domain are:

	Action	Responsible	Approver	Consulted	Informed
a.	Coordinate project oversight committees and other key meetings	David Jennings	Larry Page	Participants	PIs
b.	Plan for long-term sustainability, including participation with NIBA	Larry Page	NSF	Community, General Public, iDigBio Staff & Leadership	Steering Committee
c.	Comply with NSF cooperative agreement and reporting requirements	David Jennings, Principal Investigators	Larry Page	iDigBio Staff & Leadership	PIs
d.	Build and maintain strategic partnerships	David Jennings, PIs, iDigBio Staff	Larry Page	iDigBio Staff & Leadership	PIs, NSF
e.	Plan and monitor project budget and expenditures	David Jennings	Larry Page	iDigBio Leadership	PIs
f.	Implement a structure to measure progress against goals	David Jennings	Larry Page	iDigBio Leadership	PIs
g.	Manage internal and external communications, including broad dissemination of outcomes	David Jennings	Larry Page	iDigBio Staff & Leadership	iDigBio Staff & Leadership
h.	Develop and maintain collaboration and communication capabilities	Kevin Love	David Jennings	iDigBio Staff & Leadership	iDigBio Staff & Leadership
i.	Serve as the central resource for ADBC and the collections community, including promotion of cohesion and interconnectivity	David Jennings	Larry Page	iDigBio Staff & Leadership	iDigBio Staff & Leadership, NSF

3.1.2 Education and Outreach

iDigBio E&O activities are focused on digitization curricula development, stakeholder identification, E&O materials and protocols, and public speaking engagements, which are recorded and published for national impact. The key objectives of the iDigBio E&O domain are:

	Action	Responsible	Approver	Consulted	Informed
a.	Foster project awareness within the scientific and collections communities	Bruce MacFadden	Steering Committee	iDigBio Staff & Leadership	Collections Community
b.	Engage the public and collections community through resources and opportunities that highlight the importance of biodiversity collections and digitization	Bruce MacFadden	Steering Committee	iDigBio Staff & Leadership	General Public
c.	Identify and assess the needs of target audiences, downstream user groups, and other stakeholders, and execute outreach activities to meet those needs	Bruce MacFadden	Steering Committee	Shari Ellis	General Public
d.	Identify and assess the needs of downstream partners and stakeholders, and execute outreach activities to meet those needs	Bruce MacFadden	Steering Committee	Shari Ellis	General Public
e.	Develop outreach resources related to digitization and biodiversity	Bruce MacFadden	Steering Committee	iDigBio Staff & Leadership	General Public
f.	Measure and track the impacts and outcomes of outreach efforts	Shari Ellis	Larry Page, Bruce, MacFadden	Steering Committee	iDigBio Leadership

3.1.3 Serving the Research Community

The Research domain leverages existing relationships to deliver branding and messaging related to iDigBio to foster collections/research community adoption of iDigBio's services, infrastructure, tools, resources, and data including: specimen portal, website, Wiki, Listservs, Adobe Connect teleconferencing, Workshop coordination/funding, Working Group coordination/funding, Appliance development, and Hosting of services. In addition, the Research domain highlights developments and opportunities for research using specimen data alone or in conjunction with other types of data. The key objectives of the Research domain are:

	Action	Responsible	Approver	Consulted	Informed
a.	Engage the research community to promote community adoption of iDigBio services,	Pam Soltis	Steering Committee	Collections Community, iDigBio IT & Digitization Staff	iDigBio Staff & Leadership, Collections Community, NSF

	Action	Responsible	Approver	Consulted	Informed
	infrastructure, tools, resources, and data				
b.	Promote and facilitate both traditional and novel uses of specimen data	Pam Soltis	Steering Committee	Collections Community, iDigBio IT & Digitization Staff	iDigBio Staff & Leadership, Collections Community, NSF
c.	Produce use cases of research applications of specimen data, provide them to the Cyberinfrastructure team, and help validate the effectiveness of implementation	Pam Soltis	Steering Committee	Collections Community	iDigBio Staff & Leadership, Collections Community, NSF
d.	Seek opportunities for integration of iDigBio specimen data and API services with key data and research services from other projects and organizations	Pam Soltis, José Fortes	Steering Committee	Collections Community, iDigBio IT & Digitization Staff	iDigBio Staff & Leadership, Collections Community, NSF
e.	Identify strategic partners in the research and collections community and develop synergistic relationships with those partners	Pam Soltis, David Jennings	José Fortes, Greg Riccardi	PIs, iDigBio IT & Digitization Staff	iDigBio IT & Digitization Staff
f.	Measure and track the outcomes of research use efforts	Shari Ellis	Larry Page, Pam Soltis	Steering Committee	iDigBio Leadership

3.1.4 Digitization

iDigBio digitization experts work with the community to understand gaps in workflows, processes, practices, and tools that prevent effective and efficient specimen digitization. These digitization-related activities are catalyzed by site visits, virtual and on-site workshops, working groups, contact with tool developers, and user contact to foster a high-degree of community involvement. The observations and subsequent analyses from these activities yield documentation, papers, training materials, and presentations that promote effective digitization practices and workflows, including qualitative and quantitative measures of success. The key objectives of the Digitization domain are:

	Action	Responsible	Approver	Consulted	Informed
a.	Engage the collections community to market and build interest in adopting iDigBio services, infrastructure, tools, resources, and data	Deb Paul, Gil Nelson, Joanna McCaffrey	Greg Riccardi	Steering Committee, Collections Community	iDigBio Staff & Leadership, Collections Community
b.	Establish minimum information standards	Gil Nelson, MISC Working Group	José Fortes, Greg	Collections Community	iDigBio IT & Digitization Staff,

	Action	Responsible	Approver	Consulted	Informed
	and data fitness for use parameters		Riccardi		Collections Community, NSF
c.	Develop, optimize, and disseminate digitization workflows	Deb Paul, Gil Nelson, Joanna McCaffrey	Greg Riccardi	Collections Community	Collections Community, NSF
d.	Conduct digitization training and produce online training materials	Deb Paul, Gil Nelson	Greg Riccardi	Collections Community	Collections Community, NSF
e.	Increase awareness and utility of digitization tools and resources that can improve efficiency and scalability of digitization efforts	Deb Paul, Gil Nelson, Joanna McCaffrey, Austin Mast	Greg Riccardi	Steering Committee	Collections Community
f.	Evaluate, document, and publish analyses related to digitization hardware and software tools	Deb Paul, Gil Nelson, Joanna McCaffrey	Greg Riccardi	Collections Community	Collections Community
g.	Identify gaps, bottlenecks, and challenges in digitization efforts, standards, and best practices	Deb Paul, Gil Nelson, Austin Mast, Greg Riccardi, David Jennings, Joanna McCaffrey	Steering Committee	Collections Community	NSF

3.1.5 Cyberinfrastructure

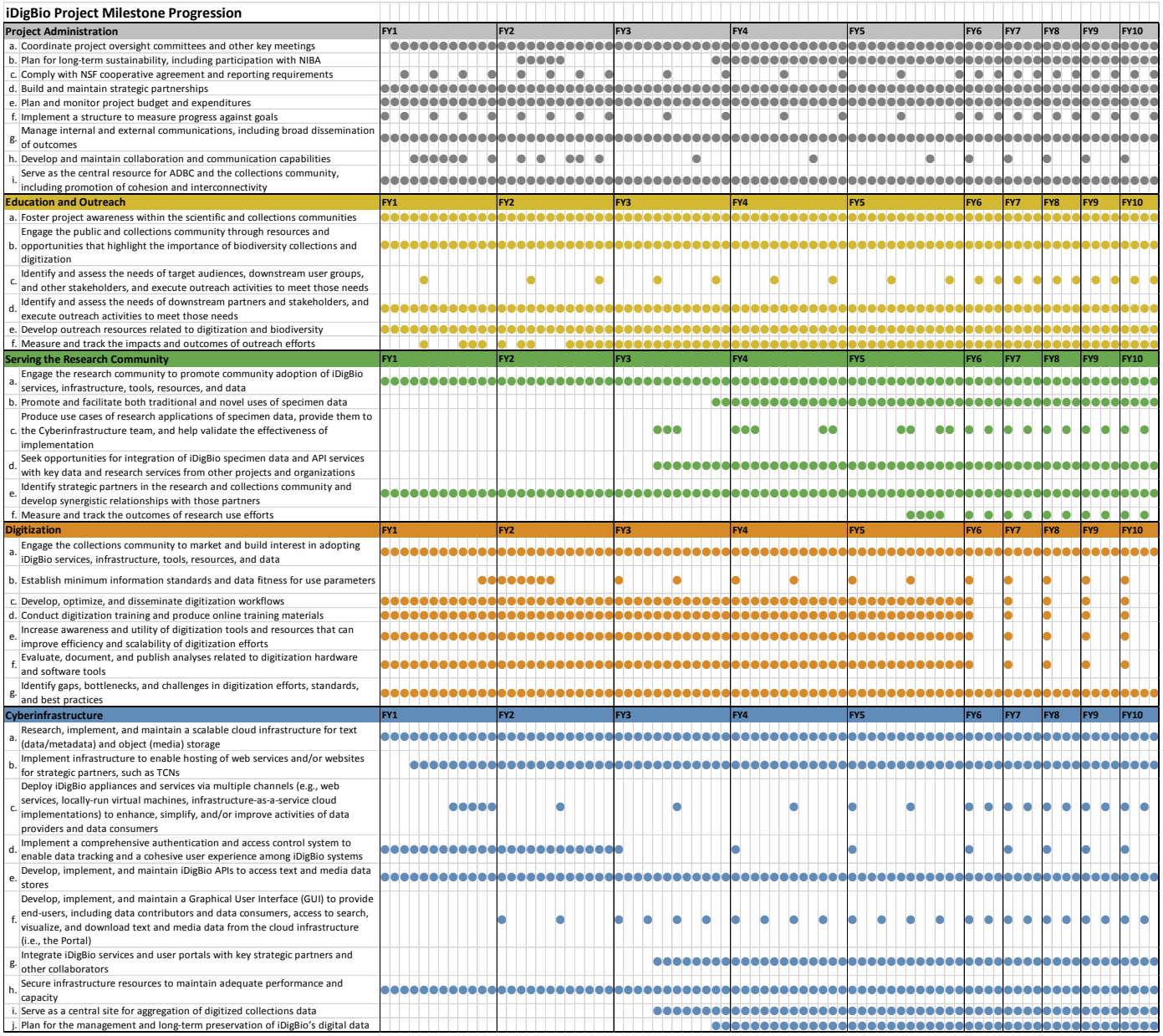
Cyberinfrastructure decisions are informed by the experience and expertise of ACIS personnel, key stakeholders in iDigBio, biodiversity community input, and information technology community input. The Cyberinfrastructure implementation process follows a formula that balances strategic planning with the agility to meet new challenges, short-term project needs, and enhanced/clarified specifications. The cyberinfrastructure team releases new features and upgrades to the specimen portal on a semi-annual basis. The key objectives of the Cyberinfrastructure domain are:

	Action	Responsible	Approver	Consulted	Informed
a.	Research, implement, and maintain a scalable cloud infrastructure for text (data/metadata) and object (media) storage	Alex Thompson, Matt Collins	José Fortes	Collections Community IT Resources	Steering Committee
b.	Implement infrastructure to enable hosting of web services and/or websites for strategic partners, such as TCNs	Alex Thompson, Matt Collins	José Fortes	Requestor, Steering Committee	Requestor, General Public

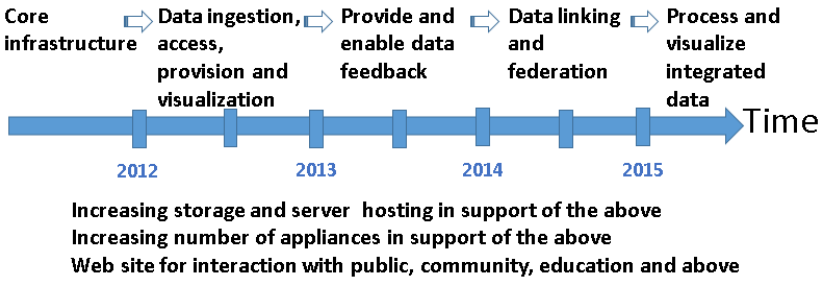
	Action	Responsible	Approver	Consulted	Informed
c.	Deploy iDigBio appliances and services via multiple channels (e.g., web services, locally-run virtual machines, infrastructure-as-a-service cloud implementations) to enhance, simplify, and/or improve activities of data providers and data consumers	Renato Figueiredo	José Fortes	Requestor, Steering Committee	Requestor, General Public
d.	Implement a comprehensive authentication and access control system to enable data tracking and a cohesive user experience among iDigBio systems	Alex Thompson	José Fortes	iDigBio IT & Digitization Staff	Steering Committee
e.	Develop, implement, and maintain iDigBio APIs to access text and media data stores	Alex Thompson	José Fortes	Steering Committee, Collections Community	General Public, Collections Community
f.	Develop, implement, and maintain a Graphical User Interface (GUI) to provide end-users, including data contributors and data consumers, access to search, visualize, and download text and media data from the cloud infrastructure (i.e., the Portal)	Alex Thompson, Greg Traub	José Fortes	Steering Committee, General Public, Collections Community	General Public, Collections Community, NSF
g.	Integrate iDigBio services and user portals with key strategic partners and other collaborators	Andréa Matsunaga, Alex Thompson	José Fortes	Steering Committee, Collections Community	Steering Committee, Collections Community, NSF
h.	Secure infrastructure resources to maintain adequate performance and capacity	José Fortes	Executive Committee	Steering Committee	iDigBio Staff & Leadership
i.	Serve as a central site for aggregation of digitized collections data	José Fortes	NSF	Community, General Public, iDigBio Staff & Leadership	Steering Committee
j.	Plan for the management and long-term preservation of iDigBio's digital data	José Fortes	NSF	Community, General Public, iDigBio Staff & Leadership	Steering Committee

3.2 Baseline Milestone Schedule

The following diagram illustrates the conceptual progression of the high-level domain milestones:



The following diagram illustrates the conceptual progression of the tangible data outcomes:



3.3 Assessment and Evaluation

3.3.1 Approach

iDigBio's Project Evaluator, a professional with training in social science and expertise in evaluation, oversees assessment and evaluation of iDigBio-supported activities. The evaluator employs a multi-method approach including participant observation, surveys, interviews, analysis of project records, and tracking of data use and publication. The evaluator participates as an observer in annual Summits and Retreats, meetings of the Steering Committee, Internal Advisory Committee, External Advisory Board, periodically in IT meetings, and as an advisor in Core Team meetings and Working Groups (e.g., E & O and Georeferencing). The evaluator collaborates with iDigBio personnel and partners (e.g., Data Carpentry, Small Collections Network, and WeDigBio) on the development of instruments for needs assessment and evaluation and provides summary reports. The evaluator also conducts evaluations of project management, leadership, and communication.

The purposes of iDigBio's assessment and evaluation efforts are to:

a. Document progress against goals in the five domains: (a) project management, (b) education and outreach, (c) serving the research community, (d) digitization, and (e) cyberinfrastructure;
b. Perform assessments to determine the needs of iDigBio's various constituencies, stakeholders, and audiences in order to develop effective tools, services, training, outreach, and communication;
c. Conduct formative evaluation of iDigBio efforts spanning the five domains listed above; and
d. Measure the impact of iDigBio on the national effort to digitize natural history collections.

3.3.2 Impact Metrics: Project Administration and Management

The project administrators are charged with responsibly managing NSF funds, promoting the national effort to digitize collections, providing leadership to the collections community and digitization effort, and facilitating collaboration and interconnectivity among the collections and informatics communities to ensure progress toward a sustainable national resource of digitized collections data. The impact of these efforts will be evaluated in terms of:

- Increased cohesion among the collections community;
- Increased collaboration among the collections and informatics communities; and
- Progress towards a sustainable national resource of digitized collections data.

3.3.3 Impact Metrics: Education and Outreach

The primary activities of the Education and Outreach group are to develop resources related to digitization and biodiversity, disseminate those resources through outreach (face-to-face, online, and other media), and create opportunities for the public and collections community to engage with digitized biodiversity collections. The impact of these efforts will be evaluated in terms of:

- Increased awareness of iDigBio and the national effort to digitize collections by the public and collections community;
- Increased appreciation of biodiversity and digitized collections by the public and collections community; and
- Resources developed by the project and partners meet the needs of target audiences, downstream user groups, and other stakeholders, and facilitate their efforts (e.g., use of digitized specimen data to teach about biodiversity).

3.3.4 Impact Metrics: Serving the Research Community

Project efforts under this domain involve collaborating with biodiversity scientists to facilitate novel and traditional uses of collections data. Impact will be evaluated in terms of:

- Increased use of digitized collections data in research; and
- Increase in novel research uses of digitized collections.

3.3.5 Impact Metrics: Digitization

The focus of the this domain is to establish standards, disseminate optimized digitization workflows, identify gaps, bottlenecks, and challenges in digitization efforts, standards, and best practices, provide expert guidance regarding digitization hardware and software tools, identify digitization challenges, and train the collections community. Impact will be evaluated in terms of:

- Increased rates of digitization;
- Increased efficiency of digitization;
- Increased use of digitization best practices; and
- Increased awareness of data quality.

3.3.6 Impact Metrics: Cyberinfrastructure

The primary activities of the cyberinfrastructure team are to build a scalable cloud-based infrastructure to serve as a stable, long-term site for the aggregation of digitized collections

data, and to provide the tools needed in order for a broad range of audiences to access the data and use it in ways that meets a variety of needs. Impact will be evaluated in terms of:

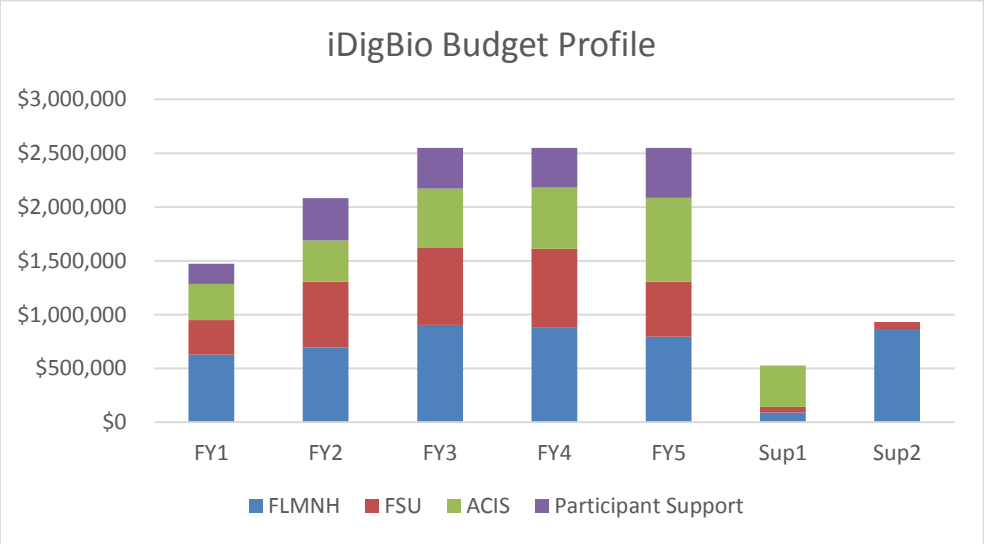
- Improved availability of and access to digitized collections data; and
- Increased use of the specimen portal by downstream users.

3.4 Budget and Justification

The original planned budget for the project was $10,000,000 over 5 years. However, the budget has grown slightly as iDigBio's activities have increased and become more complex.

Prior to the start of each fiscal year, the iDigBio leadership reviews and revises the budget as required to meet the continuing programmatic needs of iDigBio. Additional staff and expenses are requested when necessary to complete ongoing tasks related to administration, cyberinfrastructure, digitization, and broader impacts. The justification for each fiscal year's budget request is provided to the cognizant NSF program officer along with the request itself.

The following chart presents the budget profile for the iDigBio project, including the two supplemental funding requests requested and received:



The University of Florida utilizes three accounts to allocate and track expenditures on the project:

- 00096061 – Main iDigBio account; housed at FLMNH; includes the subcontract with FSU
- 00096084 – Account for Participant Support; housed at FLMNH
- 00096105 – Account for Cyberinfrastructure; housed at ACIS

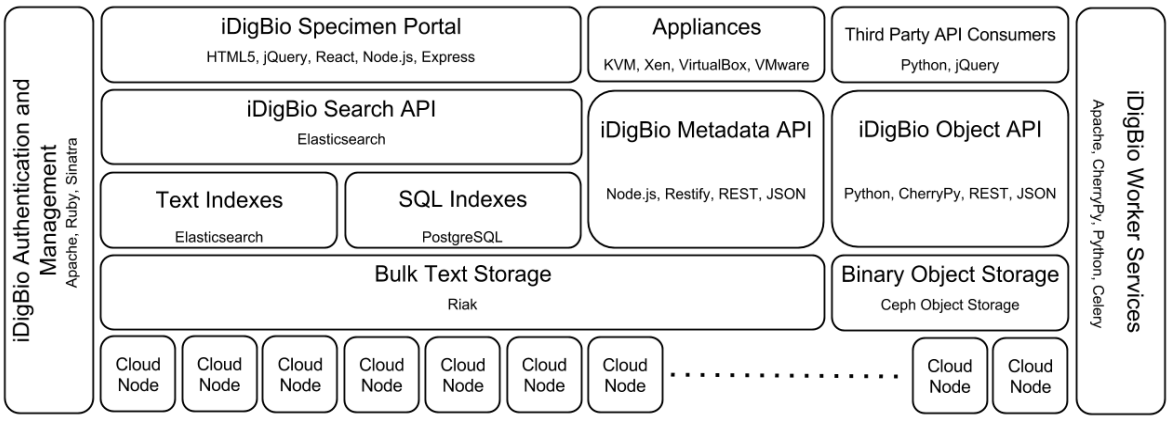
Details of the budgets, expenditures, and encumbrances are available through UF's online myinvestiGator tool. The following table outlines the budgets allocated to each category within the UF accounting system:

Budget Category	PROJECT	FY1	FY2	FY3	FY4	FY5	Sup1	Sup2
All Payroll	$4,340,548	$562,139	$587,526	$822,112	$833,755	$902,725	$262,313	$369,978
Personnel - Salary	$2,446,985	$314,160	$311,084	$461,400	$449,340	$498,000	$203,000	$210,000
Fringe Benefits	$861,829	$111,979	$113,722	$165,246	$157,366	$178,225	$59,313	$75,978
OPS & Other Personnel	$185,000	$20,000	$20,000	$25,000	$57,500	$62,500	$0	$0
Graduate Students	$516,646	$72,000	$97,920	$124,850	$101,876	$120,000	$0	$0
Postdoctoral	$310,088	$40,000	$40,800	$41,616	$63,672	$40,000	$0	$84,000
Undergraduates	$20,000	$4,000	$4,000	$4,000	$4,000	$4,000	$0	$0
Other Expenses	$80,000	$20,000	$20,000	$20,000	$20,000	$0	$0	$0
Computer Services	$11,400	$0	$0	$0	$2,400	$9,000	$0	$0
Consultant Services	$320,000	$0	$60,000	$60,000	$0	$0	$0	$200,000
Subrecipient <=$25K	$25,000	$25,000	$0	$0	$0	$0	$0	$0
Subrecipient > $25K	$2,986,400	$294,306	$612,506	$718,157	$732,721	$510,193	$52,557	$65,960
Participant Stipends	$1,791,977	$189,700	$391,600	$377,000	$369,677	$464,000	$0	$0
Materials & Supplies	$23,500	$4,500	$4,500	$0	$4,500	$10,000	$0	$0
Repairs & Maintenance	$0	$0	$0	$0	$0	$0	$0	$0
Tuition	$311,453	$32,172	$49,332	$70,915	$65,244	$93,790	$0	$0
Domestic Travel	$202,435	$30,000	$30,000	$42,435	$50,000	$50,000	$0	$0
Foreign Travel	$60,000	$0	$0	$0	$20,000	$20,000	$0	$20,000
Equipment	$121,444	$17,762	$0	$0	$0	$14,500	$89,182	$0
Rental - Space	$0	$0	$0	$0	$0	$0	$0	$0
Publication Costs	$15,000	$0	$0	$0	$5,000	$10,000	$0	$0
Direct Total	$10,289,157	$1,175,579	$1,755,464	$2,110,619	$2,103,297	$2,084,208	$404,052	$655,938
Indirect Total F&A	$2,372,840	$298,362	$326,442	$439,214	$446,704	$465,802	$121,975	$274,340
Project Total	$12,661,996	$1,473,941	$2,081,906	$2,549,833	$2,550,001	$2,550,010	$526,027	$930,278

3.5 Technical Considerations

3.5.1 Cyberinfrastructure

The following is a conceptual architectural diagram of the main iDigBio system components including examples of potential technology employed in each component:



3.5.2 Terms of Use

The use of iDigBio's website, including the specimen data portal, digital ingestion appliances or any of the data or information, products, or services offered is subject to Terms of Use. iDigBio's Terms of Use are available on the iDigBio website: https://www.idigbio.org/content/idigbio-terms-use-policy

3.5.3 Service Level Agreement

The resources of the iDigBio are free, publicly available, open-source computing resources and services. The purpose of iDigBio's Service Level Agreement (SLA) is to define the terms of service for the specimen data portal, digital ingestion applications, and data, information, products, and services that iDigBio offers. iDigBio's Service Level Agreement is available on the iDigBio website: https://www.idigbio.org/content/idigbio-service-level-agreement-sla

3.5.4 Intellectual Property

iDigBio has established an Intellectual Property Policy related to the presentation of content provided by collections and institutions. The policy provides certain protections to data providers to ensure that content is utilized and attributed as intended. Content consumers - including researchers, the general public, land use managers, and others - are required to abide by the Intellectual Property Policy when utilizing text, images, media, and other content provided through iDigBio. iDigBio's Intellectual Property Policy is available on the iDigBio website: https://www.idigbio.org/content/idigbio-intellectual-property-policy

4. PROJECT MANAGEMENT & IMPLEMENTATION PLAN

4.1 Division of Responsibilities

iDigBio, through its NSF award and cooperative agreement, will provide IT infrastructure and services for a highly coordinated biocollections digitization community to serve the needs of diverse stakeholders, from the professional scientists to the general public, and communicate the importance of this national resource to advance research and education in the 21st century. These services, due to the organizational structure of iDigBio, will be delivered through the coordination of personnel from many departments and disciplines spread across many partnering institutions.

- FLMNH Responsibilities
  - Web content creation & maintenance
  - Website Access Control List (ACL)
  - End user support & documentation
  - Theme maintenance
  - Drupal module maintenance
  - Mediawiki extension maintenance
- FSU Responsibilities
  - Web content creation
  - Digitization process documentation, workflows, benchmarking, and publication of common practices
- ACIS Responsibilities
  - Data Center Space
    - Power
    - Security
    - Communications connections
    - Environmental controls
  - Virtual Machine (VM) provisioning, hosting and networking
  - Storage infrastructure
  - Base system configuration
  - User Access Control List (ACL)
  - Operating System (OS)
    - Auth Base Code & Maintenance
    - Mediawiki Base Code & Extensions
    - Drupal Base Code & Modules
    - Redmine Base Code
  - System build/rebuild automation
  - Code repository
- Shared Responsibilities
  - Feature Development
    - Development documentation

        - Unit testing
        - Quality Assurance (QA)
    - Major service alterations
    - Service integration

4.2 Project Reporting

During the first two years, iDigBio will submit interim quarterly progress reports to NSF following teleconferences with the program director. During the last three years, iDigBio will submit interim semiannual reports to NSF following teleconferences with the program director.

Annual reports and the final report shall include information related to:

- Listing of the iDigBio participants during the previous annual funding period, including but not limited to post-doctoral scholars, graduate students, and undergraduates. Information will include demographic data and disciplinary background;
- Digitization accomplishments and reports from the Internal Advisory Committee;
- Descriptions of outreach activities, including participation of members of underrepresented groups;
- Progress on internal communication and data management systems;
- Progress on public access to, and distribution of data, software and the like, including any web sites and databases;
- Sponsored workshops with lists of participants;
- Unanticipated collaborations, digitization projects and other endeavors enabled or stimulated by the organization;
- Status of partnerships with the federal or private sector, if applicable;
- External Advisory Board meeting reports describing discussions, conclusions, and recommendations;
- Updated budget pages, work plan and timetable for the following year; and
- Quantitative and qualitative analysis of activities according to guidance provided by the NSF Cognizant Program Official, in order to document the impact of this project.

4.3 Communication Management

4.3.1 Strategy

Effective and open communication is essential to the success of the iDigBio project. Communication planning provides a framework for managing and coordinating the wide variety of communications that take place during the project. Communication management conveys clear, consistent, and timely information to stakeholders who can affect or may be affected by the objectives and outcome of the iDigBio project. The key communication objectives for the iDigBio project are:

- Engender transparency, consistency, and seamless collaboration

- Foster project awareness; promote iDigBio's mission and objectives
- Provide accurate and timely information about the project
- Ensure a consistent message

4.3.2 Resources

To achieve the communication goals, iDigBio maintains licenses for integrated collaboration and teleconferencing software. iDigBio currently utilizes Adobe Connect (idigbio.adobeconnect.com) and MeetingOne (www.meetingone.com). iDigBio communication resources are periodically reviewed to ensure they continue to meet the needs of the project.

iDigBio maintains a staff directory (https://www.idigbio.org/content/directory) with two views, one for external visitors and one for internal staff. The external view contains a brief biography of key staff members and provides a contact form to send a message. The internal view contains rich information on each staff member to promote communication and transparency throughout the project: name, office number, mobile number, email address, photo, biography, and primary iDigBio responsibilities.

iDigBio has established social media accounts – Facebook (https://www.facebook.com/iDigBio), Twitter (https://twitter.com/idigbio), and Vimeo (https://vimeo.com/idigbio) – to advance the project's objectives related to community-building, training, outreach, and other broader impacts. The goals are to build a community of students, teachers, scientists, and collection managers who are interested in digitization of biodiversity specimens and to keep these individuals updated on learning opportunities. iDigBio's social media accounts connect our diverse audiences with project information including webinar/workshop announcements and registration links, meetings with remote connection information, reports and photo galleries and other topics related to digitization, technology, biodiversity, and outreach. iDigBio's social media content will consist of original text, photos, and videos generated by project participants and/or partner institutions. Some links and embedded photos/videos may be derived from external sources. The images shared are related to biodiversity fieldwork, training, outreach, and other topics associated with the project.

4.3.3 Internal Communication

Audience	Message	Method	Frequency	Communicator
Core Team	• Coordinate activities • Establish priorities • Support operations	• Email/Phone • Meetings • Teleconferences • Minutes & Action Items	Weekly	Project Manager
IT Team	• Data integration • Computational needs • Assessment of new technologies/platforms to facilitate digitization efforts	• Email/Phone • Meetings • Teleconferences • Minutes & Action Items	Weekly	Cyberinfrastructure PI

Audience	Message	Method	Frequency	Communicator
Executive Committee	• Project management and oversight • Accomplishment of mission and goals	• Email/Phone • Meetings • Teleconferences • Minutes & Action Items	Monthly	Project Manager, Lead PI
Steering Committee	• Review progress & coordinate activities • Resource allocation • Strategic directions and management policies	• Email/Phone • Meetings • Teleconferences • Minutes & Action Items	Monthly	Project Manager
Internal Advisory Committee	• Report on progress of digitization efforts • Share and identify best practices and standards • Identify gaps in digitization areas and technology • Enhance training efforts • Foster collaboration	• Meetings • Teleconferences • Minutes & Action Items	Bi-monthly	Project Manager, Biodiversity Informatics Manager
Other TCN/PEN Representatives	• Build community • Foster collaboration • Communicate iDigBio events & activities • Enable digitization	• Email • Meetings • Teleconferences • Minutes & Action Items	Continual	iDIgBio staff

4.3.4 External Communication

Audience	Message	Method	Frequency	Communicator
External Advisory Board	• Advice on progress and integration of digitization projects, research, training, and outreach activities among all funded institutions • Advice on strategic directions and management policies	• Meeting • Teleconference • Published minutes	Yearly	Project Manager, PIs
NSF Program Officers	• Progress report • Future planning	• Teleconference	Bi-weekly	Lead PI
NSF	• Quarterly report • Semiannual report • Annual report	• research.gov	Quarterly, Semiannual, & Annual	Project Manager, PIs
Community and General Public	• Build community • Communicate iDigBio events & activities • Promote digitization and biodiversity	• Facebook • Twitter • Vimeo • iDigBio.org	Continual	iDigBio staff

4.4 Human Resources Management

4.4.1 Strategy

Human Resources Management will help ensure that the iDigBio project has sufficient staff possessing the correct skill sets and experience to ensure successful project completion. The key human resources management objectives for the iDigBio project are:

- Acquire appropriate human resources with the necessary skills
- Provide training when skill gaps are identified or when additional skills are required
- Effective management of team activities

4.4.2 Staff Acquisition

Staff will be acquired using the normal university hiring process. Position descriptions and minimum qualifications will be prepared and processed through the normal Human Resources channels. The Project Manager will coordinate with Human Resources to determine the appropriate staff classification, advertise the position, schedule the interviews, and select the staff.

4.4.3 Staff Training

When a new member staff joins the project, the staff person's supervisor will provide an orientation to the project, which should include the following topics:

- Project background
- Current status of the project
- Specific job duties and expectations
- Introduction to the other project staff
- Overview of the facility and infrastructure.
- Overview of project processes

Throughout the project, each supervisor and their staff should discuss where additional training might be needed to ensure staff has the necessary skills to execute the activities for each project phase.

4.4.4 Staff Transition

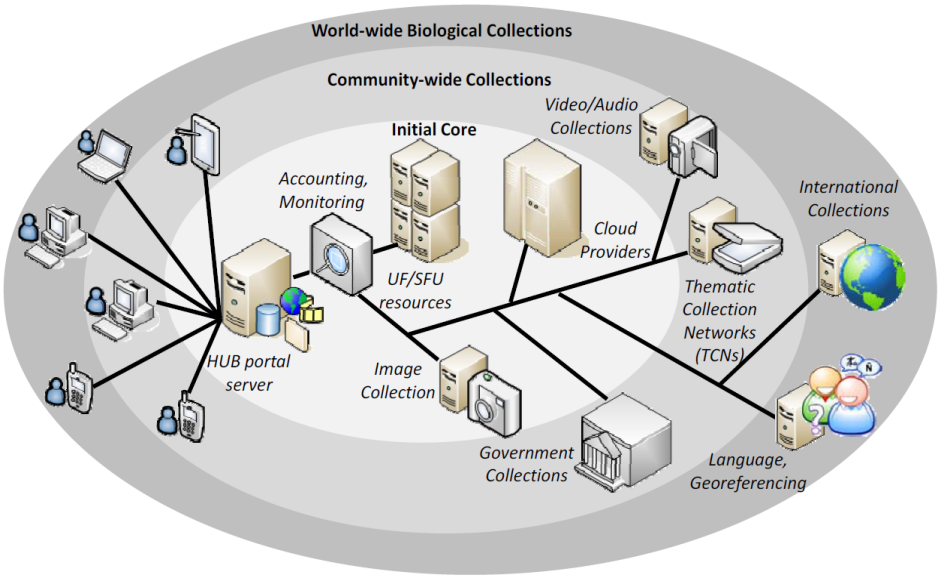
In the event staff desire to transition prior to the completion of the project, the staff supervisor will assume or reassign the departing staff responsibilities. The staff supervisor is responsible for ensuring any pending work is transferred to a remaining staff member to ensure timely transition and completion of the work.

4.5 Data Management

4.5.1 Strategy

iDigBio focuses on data management in terms of collection data as a community resource. The following figure conceptualizes the integrative nature of iDigBio and the potential evolution of

the system as it serves end users, aggregates collections data, and leverages resources and capabilities of stakeholders at the national and international levels.



4.5.2 Process

iDigBio treats data management, software, digital resources, and workforce with a view towards developing a mature national cyberinfrastructure, and not just a collection of external and internal tools that are used in the community. iDigBio is collaborating with other stakeholders on transforming the strategic vision into an operational blueprint that integrates and interoperates with national and international resources, campus networks, and computational infrastructure. There is still a clear need for mechanisms through which community software development projects (e.g., Specify, GeoLocate, Filtered Push) can integrate through a national ecosystem of useful, usable, and healthy infrastructure that supports data federation, ongoing sustainability, and usability. This must be balanced with the need to innovate and prototype through creative processes.

4.5.3 Intellectual Property

A key principle with iDigBio is that it will not exert ownership of digital data but will work to facilitate the intellectual property, management, and dissemination on behalf of those resources. iDigBio's Intellectual Property Policy is available on the iDigBio website: https://www.idigbio.org/content/idigbio-intellectual-property-policy

4.5.4 Sustainability

Museums, like libraries, are among few types of organizations with missions oriented around strong commitments for curation of both physical collections and the data associated with the specimens, so establishment of iDigBio within the structure of one of the largest university-based natural history museums in the country provides a context for long-term sustainability of the national resource. A core strategy for maintaining a sustainable national resource of digital

collection data will be to establish partnerships with other national and international digitization initiatives.

4.5.5 Best Practices and Standards

Best practices and standards are being articulated, communicated, and openly available to the community so that they can generate, curate, and maintain collections. iDigBio utilizes workshops, working groups, and web/other media-based methods to engage the community to establish needs.

4.6 Issue Management

4.6.1 Strategy

Issue Management defines the iDigBio's approach for the identification, analysis, and management of project issues The project implementation process follows a formula that balances strategic planning with the agility to meet new challenges, short-term project needs, and enhanced/clarified specifications. The key issue management objectives for the iDigBio project are:

- Issues are identified, assessed for impacts to the project, and resolved.
- Issue resolutions that have significant impacts to schedule, scope, budget, and quality become part of the formal change management process.
- Resolved issues are properly documented and communicated to project team members and stakeholders.
- Describes what tools iDigBio will use to support the issue management process.

4.6.2 Process

(1) All internal and external features, bug fixes, and functional requests are documented as new Issues in the appropriate project in Redmine (www.idigbio.org/redmine).

(2) The ticket is assigned to an appropriate Subject Matter Expert (SME) to review the request based on completeness, feasibility, and applicability to iDigBio Scope, etc. Items that require additional information will be delegated as appropriate, including consultation with the iDigBio PIs to discuss the scientific merits of requests.

   a. Requests that pass the "sanity check" will be presented at one of the regular iDigBio meetings for discussion and recommendation for approval or disapproval.
   b. Disapproved requests will be closed in Redmine including comments about the reason for rejection.
   c. Approved requests will be further developed as formal requirements and use cases. Community outreach and research community involvement, as well as additional input from the original requestor, will be required for this activity.

(3) Formal requirements and use cases will be translated into technical requirements by ACIS and assigned an estimate of hours for completion. Task dependencies will also be identified (i.e., the feature cannot be implemented until another specific task has been finalized).

(4) The formal requirements and use cases will be reviewed again to ensure that they have been developed as expected and remain within project scope. Implementation dates of approved requests are added to the roadmap for future development and product release, and the project plan is updated accordingly.

4.7 Quality Management

4.7.1 Strategy

The purpose for managing quality is to validate that the project deliverables are completed with an acceptable level of quality. Quality management assures the quality of the project deliverables and the quality of the processes used to manage and create the deliverables. The key quality management objectives for the iDigBio project are:

- Project deliverables meet their requirements
- Project management processes are appropriately followed

4.7.2 Metrics

Quality is the degree to which the project deliverables and project processes fulfill their requirements. The entire project team shares responsibility for the quality of the deliverables and processes. The following are the quality management metrics:

Objects of Quality Review	Quality Measure	Quality Evaluation Activities
Project Deliverables	• Deliverable quality standards • Customer satisfaction	• Core Team meetings • Executive Committee meetings • Steering Committee meetings • Internal Advisory Committee meetings • Workshop/event surveys • Internal project surveys • NSF reporting
Project Processes	• Process quality standards • Stakeholder expectations	• Refine Implementation Plan • Refine Strategic Plan • Project reviews • Community surveys

4.8 Change Management

4.8.1 Strategy

Change management planning provides a roadmap for decision making, approving, and reporting change when it occurs. Change occurs when the project's resources, costs, project plan, timeline, deliverables, specifications, and/or quality are affected by a particular course of action. Managing change requires planning, discipline, and effective communication among the project team, project leadership and management, and internal and external stakeholders. The key change management objectives for the iDigBio project are:

- Establish standardized methods, processes and procedures for all project changes
- Facilitate efficient and prompt handling of changes
- Balance the benefit of a change with the risk or impact of the change on the project

4.8.2 Process

(1) Potential changes are identified, typically during meetings with team members, management, or other internal and/or external stakeholders. Sources of change include, but are not limited to:
    - Responses to internal project issues (e.g., bug fixes, budget reductions)
    - System enhancement requests
    - Changes in project requirements or strategy
    - Proactive changes to improve product performance, scope, or quality
(2) The change is documented in the form of an Issue in Redmine (www.idigbio.org/redmine).
(3) The ticket is assigned to an appropriate Subject Matter Expert (SME) to analyze the impact of the change request on resources, schedule, budget, and quality.
(4) The SME analyzes the request and documents the impact of the change including feasibility of making the change, any impacts and/or risks associated with making (or not making) the change, and any impacts to the project schedule and budget.
(5) The SME recommends whether to authorize, reject, or defer the change request.
    a. If approved, the Project Manager determines if the change is of significant magnitude based on the impact to project scope, resources, costs and/or schedule impact. Significant changes require additional review:
        i. Significant changes that are within the current project scope require assessment and approval by the Executive Committee (PIs).
        ii. Significant changes that expand or modify the project scope require assessment and approval by the Steering Committee and NSF Program Officer.
    b. If approved following Project Manager and higher-level review (if required), project documentation, schedule, and budget are updated as required to reflect the change. Impacted stakeholders are notified. The ticket is monitored and updated until the work is complete.
    c. If rejected or deferred, the ticket is updated with the reasons for rejection or deferral and the ticket is closed.

4.9 Risk Management

4.9.1 Strategy

Risk management planning provides a systematic process of deciding how to approach, plan, and execute risk management activities throughout the life of the project, which serve to maximize opportunities and minimize threats to the project objectives. The project will use a qualitative approach to risk management including:

- Periodic monitoring for the realization of risks previously identified
- Notification of key stakeholders of any impacts of realized risks
- Continual management of stakeholder expectations

4.9.2 Definitions

Term	Definition	Measure or Strategy
Occurrence Likelihood	Qualitative assessment of the probability of the risk occurring	High, Medium, or Low
Cost Impact	Qualitative assessment of the impact to the project budget	High, Medium, or Low
Schedule Impact	Qualitative assessment of the impact to the project schedule	High, Medium, or Low
Trigger	Warning signs that could indicate the risk is likely to occur or will occur soon	Used to determine when to implement mitigation strategies
Mitigation Strategy	Specific actions intended to reduce the impact of the identified risk	**Avoidance** seeks to eliminate the possible deviation by changing the project deliverables. For a negative risk, this could mean deciding not to undertake the deliverable. For a positive risk, this could mean exploiting the opportunity by incorporating it into the project as a planned deliverable. **Mitigation** seeks to alter the likelihood or impact of the risk. For negative risks, steps may be taken to reduce the probability that risk factors will cause a deviation from the project plan or to reduce the amount of deviation. **Acceptance** merely acknowledges the risk, but does not specify any action to take in response to it.

4.9.3 Process

(1) Potential risks are identified, typically during meetings with team members, management, or other internal and/or external stakeholders. Risks are encountered in every aspect of project execution. Some factors that may affect the development of a project include
   - **Budget risks**: Risk that budget elements will deviate from the estimate
   - **Event risks**: Risk of internal or external events that affect the ability of the project team to meet the project deliverables on schedule
   - **Scope risks**: Risk of significant changes to the project scope due to external influences

(2) Potential risks are documented in the form of an Issue in Redmine (www.idigbio.org/redmine) using the Risk tracker.

(3) The ticket is assigned to the Project Manager or an appropriate Subject Matter Expert (SME) to analyze the risk.

(4) The Project Manager or SME analyzes the risk in terms of likelihood, cost impact, and schedule impact, and then documents the recommended mitigation strategy and anticipated risk triggers.

(5) The Project Manager and/or Subject Matter Expert (SME) will periodically review documented risks for triggers that may cause a risk to be realized. This process is informal, but will be executed throughout the duration of the project.

(6) For any identified trigger, the Project Manager will determine if the associated risk is realized and make a preliminary determination if mitigation strategies should be implemented.

   a. The Project Manager will consult with the Executive Committee and/or Steering Committee for risks with a significant impact to the project
   b. The Project Manager will ensure that appropriate action is taken to implement the mitigation strategy agreed upon for the realized risk.
   c. The ticket will be updated with information regarding the identified trigger and the mitigation actions taken.

(7) Key stakeholders and decision makers will be notified of realized risks through regularly communication.

4.10 Project Closure

The purpose of project closure is to ensure that all pertinent project records are identified, labeled, and properly maintained for easy retrieval at a later date. Project closure activities should be executed throughout the course of the work, not just at the end. Examples of closure activities include:

- Project evaluation, reward, and recognition
- Document lessons learned that can help improve future projects
- Archiving of project materials and documentation