CALIFORNIA INVASIVE PLANT MAPPING AND DATABASE ROUNDTABLE
UNIVERSITY OF CALIFORNIA-DAVIS
JUNE 5, 2006

Information related to the California Invasive Plant Mapping Consortium will be posted at www.cal-ipc.org

CASE STUDIES OF WEED MAPPING EFFORTS

Invasive Spartina Project- *Katy Zaremba, ISP Mapping Coordinator*

1. Goals:
   a. Determine abundance of invasive hybrid in SF Bay and outer estuaries
   b. Determine annual change in area of all species
   c. Determine influence of bay region, sediment, elevation, and site type on change in area
2. Monitoring
   a. Annual estuary-wide survey
   b. Two components:
      i. Field based - marsh/shoreline that is relatively accessible, growing season June-Oct
      ii. Aerial photo interpretation - larger or less accessible marshes. Color IR photos flown in late summer and rectified, digitized

5. Field monitoring
   a. Trimble GPS unts with a custom Spartina monitoring data dictionary
   c. Mapped as point, line, or polygon (diameter, width, cover, etc.)
   d. Species ID'ed by morphology
   e. Genetics used to confirm field ID and questionable species
6. Aerial photo interpretation
   a. 1:6000 ft, low tide, peak of growing season (Aug). Native flowers earlier than non-native but because inflorescences small, not easy for telling them apart
   b. Mapped with subcontractors - difficult to get photos on time, this year will be working in-house
   c. Heads-up digitization, as polygons with field parameters, 1:500 scale
   d. Can't distinguish hybrids from native species with these methods
   e. Need field and genetic data to confirm species
7. ISP coordinates and assists control programs around the bay to determine most appropriate treatment at various sites
   a. Last year 32 monitoring sites out of 37 treatment sites
   b. This year will treat all sites (1000 ac, 134 sites). Will monitor 51 sites with plots randomly spaced along transects
   c. Treatment and monitoring stratified across types of marshes
8. Will be migrating data to a geodatabase this year. Data currently stored as shapefiles.

Northeast WMA Collaboration - *Paul McCanna, Siskiyou County*

1. Focuses on preventing new infestations
    a. 5 national forests in the county, Bureau of Rec., Shasta Co. is 72% public land
2. WMA is huge collaboration among agencies
    a. Can set up own standards for recording data
    b. Can now use personal geodatabases and easy to import files to bring into geodatabase
    c. Three of five forests collecting data on their land
    d. Not focusing on weeds that are already a big problem, focusing on state A-rated weeds and some B and C-rated weeds that are A-rated within the county
    e. Collaborate with Shasta, Lassen, Modoc WMAs
        i. Have also collected data from rest of state for statewide A-rated weed map
        ii. Those four counties have lots of A-rated weeds
    f. Rural counties don't have funding for much management, but have significant problem

A. Large GIS shop collecting and aggregating data across 4 counties
B. Data is stored in a ESRI geodatabase format
C. Using Trimble and Garmin GPS units for field collection
D. Developed custom script/tool to combine multiple weed data sets with varying attributes into a single geodatabase.
E. Uses GPS tracklog information in ArcPad (it traces route covered during a field mapping session) in combination with a viewshed analysis (using the Spatial Analyst toolbox) to derive negative data areas.
F. Private landowners in his region have shown some reluctance in regards to having weed data being hosted on the web

Yosemite National Park/ USGS Inventory - *Peggy Moore, USGS*

1. Project started 1988. Park had no information on where non-native plants were located within Yosemite, Sequoia, and Kings Canyon Parks
    a. Alien control for decades, but mostly opportunistic using volunteer labor
    b. Chapparal, hardwood forests, alpine, montane meadows
    c. Describes plants present and threat to ecosystems
    d. Some existing survey data, low occurrence of weeds compared to other areas
    e. Undisturbed areas had few alien plants
2. Goals:
    a. Describe distribution and abundance of non-native plants
    b. Identified likely areas of establishments, anthropogenic disturbance
    c. Directed surveys
        i. Complete lists of all non-natives present
        ii. Site characteristics
        iii. Road and trails
3. Targeted surveys:
    a. Campground, visitor facilities, stock pens, roads and trails, some pastures and historic sites
    b. Inventories non-native species
    c. Recorded abundance on log scale
    d. Trails: 3km from trail head, Roads: 1km segments

    e. All species vouchered at herbarium
4. Tools for managers:
    a. Alien plant distributions
    b. Summary of published info where available
    c. GIS themes store
5. Yosemite:
    a. Mapping specific species for control (blackberry, YST, post-fire infestations)
6. Weighted distribution against controllability, but for many species used gray literature and expert opinion to prioritize species

Oak Mortality Task Force Mapping Website - *Karin Tuxen, UC Berkeley*

1. Sudden Oak Death
    a. Forest disease, CA and southern Oregon
    b. Large interdisciplinary group
    c. Oak Mapper application
2. Task force provides mapping support to group working on problem
    a. www.suddenoakdeath.org
    b. Tools:
        i. Public access - downloadable maps, webGIS, animations
        ii. Research - remote sensing and spatial modeling
    c. All publicly available maps are on our website
        i. Maps - state, local, county, pdf/tif/jpg
        ii. Google maps application for viewing background imagery
        iii. Google Earth application coming soon
    d. Oakmapper allows visitors to submit information
        i. Use Google map to provide snapshots of information
        ii. Displays positives confirmation of sudden oak death (samples taken) or SOD sightings of symptomatic trees not yet confirmed. Anyone can submit data.
    e. Disease makes visible overstory mortality, allows for remote sensing
        i. Multi-temporal remote sensing
        ii. Allows visualization of where mortality happening
        iii. Overlaid with climate and precipitation data to predict future spread as an input to risk models
3. More information:
    a. www.suddenoakdeath.org
    b. http://kellylab.berkeley.edu/SOD/Monitoring
    c. http://giif.cnr.berkeley.edu
    d. http://kellylab.berkeley.edu/publications.htm

A. OakMapper Mapping Program (Internet-based; four components – www.suddenoakdeath.org)
    1. Static downloadable SOD maps (.jpg, .tif, .pdf) offered at three scales – statewide, county, vicinity
    2. ArcIMS – data can be downloaded and observations can be uploaded into the site

a. Uploaded data stored as observed (unconfirmed) records.
b. Data is then field-checked and "observed" records are updated to confirmed (official) sitings.

3. Google Maps API (Application Program Interface) – OakMapper data packaged in a Google maps interface; includes basic browsing functionality
4. Google Earth API – coming soon (still working on the bugs)

B. Remote Sensing Program
1. Detection using Color IR imagery (1meter resolution)
2. Models are being developed (based on climate, elevation, and a series of other factors) to determine potential SOD spread across the United States

AGENCY/ORGANIZATION SUMMARIES OF CURRENT PROGRAMS

1. **CA State Parks -** *not present*
Inventoried all units for presence/absence. Will start taking GPS points, using modified WIMS system

2. CA Fish and Game- *Julie Horenstein, Tom Lupo*
a. New invasive species program within Habitat Planning branch
b. has pesticide reporting by unit, veg type mapping, CNDDB
c. Work with programs that manage ecological reserves, etc.
d. Don't have mapping program. Pesticide program advisor has information about infestations on CDFG properties, but not spatial data.
e. Biogeographic data branch - Data managers for scientific data. Focus on biological observation, veg mapping, range maps, National Diversity Database. BIOS web service. So far no involvement in invasive species because not one of their mandate, although is an interest. Many of their systems could be applied to other types of data.

A. No weed mapping program initiatives currently in place
B. Newly formed Biogeographic Data Branch
i. Manages NDDB, BIOS, etc.
ii. Handles all database management for biological data
iii. Hosts bio-data through an ArcIMS

3. CA Boating and Waterways - *Marcia Carlock*
Aquatic weed control for Egeria and water hyacinth. Map Sacramento-San Joaquin Delta and tributaries. Concerned about any waterway that could bring weeds. Have a GIS staff person. Use ARC applications for processing field data. Map point locations for water quality as part of environmental monitoring for herbicide control program. Have mapped locations of habitat of elderberry and giant garter snake for threatened species info. Data not standardized for use outside department. Also use hyperspectral analysis. This year will do pre-and post-treatment.

A. Weed data has been collected for the Sacramento/ San Joaquin Delta
B. Based on point locations related to WQ sampling
C. Point/line features are collected to delineate treatments
D. Not standardized for use outside department
E. Hyperspectral flyovers are taken to analyze before and after treatment condition

4. **CA Food and Agriculture -** *Colleen Murphy*

   Map A-rated weeds. Collect data on all A-rated weeds and yellow starthistle. GPS units with field biologists. Collect data from county Weed Management Areas. Use centroid data because some are small acreages. Usually after summer field season. Updated annually or as data sent to CDFA. Stored in Access but some geodatabases. Want to put it in township/range format. Moving to three-layer system: active, eradicated, etc. Focus is to make Arc GIS database more accessible.

   A. Department maps A-rated weeds
   B. Due to the statewide scale, data is collected as point features (w/ acreage estimates)
   C. Data is updated annually
   D. Data is stored as an Microsoft Access database currently (w/ x,y coordinates) Department goals include bringing an ArcIMS online in the near future

5. **CA Forestry and Fire Protection -** *Lauren McNees*

   Animals, insects, pathogens, and weeds, esp. sudden oak death, bark beetle, and pitch canker. Bark beetle maps on website. State forests work with local WMAs. Jackson forest and Mendocino WMA developing database that will be compatible with WIMS. Veg management program uses prescribed burning on forests and rangeland. FRAP program is mapping component, but no data specifically on invasive plants (fire and resource assessment). Update to come out this year.

   A. Has a pest management program in place, but it does not include invasive plants (only insect and fire related data)
   B. Program includes Fire and Resource Assessment Program (FRAP), the mapping component of the overall program)

6. **CA Biodiversity Council -** *Lauren McNees*

   State, federal and local agencies meet 2-3/yr on resource issues. Invasive species meeting late 2005. Working group working on regulatory streamlining, rapid response plan. Discussing a statewide plan on invasive species.

   A. Newly formed working group in 2005 to address weeds
   B. Working group has held two meetings
   C. No weed data has currently been collected

7. **CA Coastal Conservancy -** *not present*

   Arundo control programs and distribution maps through Wetlands Recovery Project for southern California. Also worked on Caulerpa rapid response. Along with these and Spartina project, have supported other weed programs in the state.

8. **CalTrans -** *Jennifer Malcom, Jennifer Gilles*

   CalTrans has 12 separate districts plus headquarters with their own processes. Operate project-by-project because of funding structure. Often have issues with adjacent land that they have no control over. Future: proposing right-of-way inventory. UCD did pilot study for them. Maintenance division focuses on repairing what they have, can help with doing what the Program Delivery branch wants done. Helped with YST project in foothills. Want certified weed-free straw for revegetation project, etc. to prevent weeds from coming onto site. Partner with CDFA. Each office has a person who determines what treatment to use and vegetation control plan. Try to use coordinated effort for all projects, often WMAs; otherwise will not contribute. Have problem using methods they want in some counties after plants mapped.

   A. No invasive data being collected

B. Projects are now handled in partnerships only; they will not take on an initiative alone
C. Future efforts include a proposed right-of-way (ROW) plant inventory (on a project-by-project basis)

9. **CA Water Resources -** *Harry Spanglet*

DWR maps weeds on a casual basis within state water projects, mostly Delta and Yolo Bypass. Use aerial photos if relevant to a particular project. Mostly as needed or as field biologists find A-rated weeds. Inform botanists of new weeds. Mapping from photos or GPS in the field. Stored in ArcGIS. No standardization - want to develop that.

A. Small independent weed mapping efforts take place
B. Invasives are mapped if there are large stands/areas of infestation; usually on a project-by-project basis
C. No standardized system for mapping in place

10. University of California

a. UC Berkeley, *Karin Tuxen* - College of Natural Resources, new geospatial imaging facility to work on research and outreach foci. Any geo/informatics science. Fire, wildlife, climate change, etc. Can provide a place to host data.
b. CSTARS, *Susan Ustin* - remote sensing lab. Working with Boating and Waterways for hyperspectral data of Delta. Worked on a number of species.
c. UCD Information Center for the Environment, *Jim Quinn* - Maintain CA node for National Biological Inventory. CRISIS (invasive species info service) - open source mapping system based on Minnesota mapping server.

11. **National Park Service -** *Andrea Williams*

a. Exotic Plant Mgmt Team maps what has treated and what will treat. One of several teams around the country. Park-level data, mostly project-based for planning control. Many have legacy data back 20 years. Networks of parks have done inventories, looking into Early Detection. Need to decide how to collect negative data. Looking at using WIMS. Most parks use a combination of GPS and paper data sheets. No cohesive level for all species. Wide number of species within parks. What would be helpful is best management practices, a way to track negative data and treatment efficacy, a way to share data. Also Alien Plant Control and Monitoring database linked through common infestation i.d, specific to park service.

12. US Forest Service - *Cheri Rohrer*

a. Natural Resource Info System - inventory and mapping data. Forest Activity Tracking System - accomplishments/treatments. Oracle databases with a spatial component. Using HP personal data recorders and GPS units. Primarily for project planning and risk assessment for timber sales, etc. Legacy data moved into databases.

13. USDA APHIS - *not present*

a. Pest inventory system to track pests that have national status. Emergency pests and localized pests. Mostly insect pests but some weed surveys as part of agricultural surveys. CA has few federal-rated noxious weeds so doesn't

participate in this much. NRCS has PLANTS database with maps of all plants in US. Has Arc IMS utility to allow reports of weeds.

b. has NAPIS database of pests, but CA has few federal noxious weeds.

14. **USDA ARS -** *not present*

a. Albany lab collaborates with NASA to do transect across California with hyperspectral imaging of weeds. Status? Also biocontrol agent distributions, monitoring impacts.

15. **Bureau of Land Management -** *not present*

a. Has some standardized databases. Similar to Park Service and Forest Service. Most information at local level.

16. **US Fish and Wildlife Service** - *not present*

a. Has some standardized databases. Developing database to track refuges; was also looking at WIMS database. Detailed records of endangered species distributions.

17. **CalFlora Database -** *Roy West*

a. Designed as general purpose tool for sharing distribution of all plants in CA. Close to a million records. Place, observer, date. Increasingly using point data. Users register on website. Herbarium data, kids submit data, and everything in between.

b. Working on mapping data. Halftime engineer maintains site and has added mapping tool with relief maps. Can overlay points. Working with state and national parks to obtain plant lists. User inputs a query and gets an interactive map.

c. Data is not static; information constantly added. Want to make it easy to share data and allow others to analyze data to predict risk of invasion in other Mediterranean climates. Collection of synonomy for plant name changes. Can now search name changes for new Jepson, etc. Allows people to ask questions that couldn't be asked when data is scattered. What plant is known to grow near these other plants? What weeds are associated with certain native plants?

18. The Nature Conservancy - *Barry Rice*

a. 50 state programs that each determine appropriate ways to deal with invasives. WIMS system. Looking at remote sensing but hard to match with management programs. A lot of management with monitoring, but not taking information from multiple locations and putting it into a national system. Little coordination within California.

19. San Mateo County WMA *Bill Korbholz, Friends of Edgewood Park*

a. Small-scale GIS database to track occurrences and treaments of weeds. Worked with local preserve and park to develop GIS for them. Has a website with good user interface of all species at Edgewood preserve.

20. **Southern California Arundo**- *Jason Giessow and Jason Casanova*

a. Using thinkpad to map arundo. Imagery is available for S. California. Will finish mapping San Diego County this year. Team Arundo del Norte is working in Bay area/ Sacramento region.

b. Los Angeles and San Gabriel Watershed program has received small grants to map arundo and other species. Beginning field mapping. Using spatially accurate data to aid in permitting and other activities for implementing control projects.

Hosted on a website so others can use. Can use table PCs (approx. $4000). Need unit that can handle imagery.

CURRENT OVERVIEW AND OPPORTUNITIES

Data Collection and Local Data Systems - *Steve Schoenig, CDFA*

1. People can keep local data in any format as long as it meets some minimum requirements to allow sharing among databases. Ideally want a digital system. ESRI based shape files, or link shape files to tabular database, or geodatabase to bring them together.
2. System complexity ranges from remote sensing snapshot, to spatial inventory with abundance, to systems that are regularly updated with detailed montoring of treatment success.
3. North American Weed Management Association Weed Mapping Standards have core required elements, including observation, genus/spp, infested area, canopy cover, ownership category, owner of the data, county/state/county, hydrological unit code, location
    a. All western states have agreed to adhere to these standards
    b. See www.nawma.org or mapping section of Cal-IPC website
4. WIMS
    a. Developed by the Nature Conservancy - free!
    b. Shared development
    c. Standardized system to map weeds and management work at local level
    d. Based on Microsoft Access
    e. Easy to use
    f. Can do statewide trainings
    g. May be able to develop helpdesk
    h. A biologist can migrate into a data collector. Data can be easily imported and exported into/out of spreadsheets and GIS systems
    i. Potential audience is all natural resource managers
    j. http://ice.ucdavis.edu/wims for bulletin board of information
    k. Does not produce maps, but outputs data in shapefiles to be used in maps
    l. Cost of equipment (PDAs, GPS) approximately $1200 for inexpensive units to $3000 for more rugged equipment

California Invasive Weed Mapping Consortium - *Doug Johnson, Cal-IPC*

Components of the Invasive Plant Information Commons

Potential desired technical capabilities:

<u>Near term:</u>

- Web portal for accessing content on invasive plant in the Cal-IPC Inventory
- Catalog of mapping datasets with metadata and static surveys to preview
- Simple statewide distribution maps based on WMA survey
- Simple network for posting information on “alert” species

<u>Long term:</u>

- Digital library with content on treatment, biology, projects, links, bibliographic resources, etc., linked in semantic web
- Community communication structure to build archive of expertise

- Mapping viewer of active datasets (through CRISISmaps?)
- Observation submission (through CalFlora?)

Question: Have we approached ag commissioners? They may be for it, or rural counties may have concerns about information about infestations on private property being available online. Privacy concerns will need to be addressed.

Designing a California Invasive Plant Digital Library and Online Community - *Deanne DiPietro, Sonoma Ecology Center*

1. Sharing information in a free and open way
    a. System for supporting data exchange and integration
2. NSDI Cooperative Agreement Program
    a. Grant made this meeting possible, for development of information commons
    b. Community of people cooperating to share data and remove barriers to data sharing and development
3. Data exchange standards
    a. Metadata - organizations, people, project, data
    b. Data content and structure - spatial data
    c. Vocabularies
    d. Emerging system for live data being developed by California Educational Digital Library Network
    e. Spatial data may be exchanged as NAWMA standard data in XML (GML), see UCD ICE's CRISIS Maps, a data query, display, and download system
4. Website portal
    a. Central point for communications
    b. Catalog and spatial data aggregation and open archive
    c. Synthesized data products: statewide maps, alert system
    d. Make products that individual agencies cannot do by themselves
    e. Example: Northbay Information Commons, http://northbaycommons.net
    f. See Cal-IPC Weed Data Catalog, accessible through http://ceres.ca.gov
5. Electronic Digital Library
    a. Live integration of data from its source.
    b. Post data in XML (ASCII text), commons harvesters collect data and aggregate it
    c. Develop specialized website using aggregated data
6. Data has to be moved out of existing systems and moved into XML. Will require some help to do this from a program that converts data into a simple form with no application associated with it. Requires some technical expertise to do this.
7. Currently can exchange simple NAWMA-standard data. Basically a draft form now.
    a. To find out how to convert data, contact Jim Quinn and others at ICE. They can provide help and specifications for doing this.

A. NSDI – provides funding to spearhead data sharing efforts
B. Data exchange standards
    1. first step - share metadata
    2. second step – share data and structure methodology
    3. third step – develop a common vocabulary
    4. fourth step – create a live data network (CalEDLN)

C. Data exchange interfaces (ex: CRISIS maps; having the ability to sharing data w/o exposing all information nor allowing for downloads)
D. Exchange begins with a data portal (CalEDLN – data harvesting application)

OPEN DISCUSSION AND PLANNING THE FUTURE

Centralization - some agencies are very decentralized, will be nearly impossible to coordinate. Depends on what agency wants. Partly a question of quality control. Park Service - work through the networks? Exotic Plant Teams are outside network system.

Temporal - moving weeds over time. Need a primary key (number) for a particular infestation to allow you to track movement of an infestation through different polygons. Need local trainings to show people how to track this situation in their area. People have developed ways of doing this.

Federal partners - Some agencies don't see a connection between their mandate to help endangered species and the issue of invasive species. Or the people who manage land aren't available. Or they're so busy doing biological opinions and other required activities that they can't attend something like this. What about contacting Army Corps of Engineers and Department of Defense? May need to approach local offices/installations through weed management areas that have MOUs with these agencies. Individual units may be more inclined to participate than the state offices. Because local units are active in WMAs and often on MOUs, it might be useful to have them aggregate data locally, then share.

Data currency - Any system for making datasets available needs to make sure they are updated.

Mentoring - Would be useful to have examples of what people have done. This could be a good online function.

Existing mapping capacity - Many agencies have well-developed mapping systems that have not yet been used for invasive species.

Public vs. private lands - What is appropriate for collecting and posting data for private lands? There are people who think they're helping but actually cause problems by submitting useless data. Can address that problem by using a filter. There are ways to make data "fuzzy" so individual properties cannot be determined. Any data given to a public agency becomes subject to Information Act requests. Agencies don't want to be subject to that. This needs to be dealt with from a legal standpoint, not just a technical standpoint. Allows those submitting data to choose how precisely their data is entered or displayed. Can also use public notices as public review to cover some legal requirements. Rare plant people have addressed this problem, should be consulted.

Integration vs. data ownership - There are ways to preserve some rights while allowing access to data - requiring citation and reciprocity, for example.

Standardization - See Steve's comments about NAWMA standards.

WIMS - APCAM is compatible with WIMS.

Negative data - How to collect and present? Most people aren't collecting it. Use historical data. There is a danger that someone could take maps and twist them to say nothing's being done about known weed populations. Need to show that this is a proactive approach to help make priorities for control with agencies working together. See example of CalTrans working with NOAA and Fish and Game to map structures that block fish passages on the north coast (www.calfish.org), pooled data on anadromous fish.
One purpose of negative data is to develop habitat suitability models.

Existing portals, pros and cons - All are good for what they do, but are single organizations. NBII is the closest thing to our proposed commons. This community needs its own functions and identity.
USDA PLANTS is under NBII umbrella
CalFlora
NBII
CRISIS
Would be great to add a list of mapping tools to our portal, as well as an information board on tools people have used to give advice on field mapping protocols. Submit best mapping practices.
Public submitting data could help with outreach, foster interactions at local scale

National - How do our efforts tie into national efforts?

ESRI alternatives -

Online submission - Developing online data forms for local groups

Proactive mapping - Can we map populations of plants that we're not sure are invasive?

Rapid response - It can be key to generate an administrative record quickly in order to get rapid agency response

Mandate - Is anyone pursuing a legislative mandate for statewide weed mapping?

CEQA tie-in - Is it possible to make IS mapping a required part of CEQA reviews?

Sharing imagery - Can we find ways to collaborate on aerial imagery acquisition?

PROPOSED ACTION AND POTENTIAL DESIRED TECHNICAL CAPABILITIES

Near-Term Proposals
Web portal for accessing content on invasive plants in Cal-IPC Inventory

Catalog of mapping datasets with metadata and static views to preview
Simple statewide distribution maps based on WMA survey
Simple network for posting info on “alert” species

Other ideas - training, list of training opportunities, list of resources and best practices. Cal-IPC portal already exists; we need to publicize information on how to access it.

No concerns about Cal-IPC pursuing these items and keeping group updated.