



Early Detection Protocol Development in the National Parks: Integrating All the Pieces

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(7 October 2005)

Outline

- NPS Inventory and Monitoring Program
- Vital Signs Monitoring
- Invasive Species Monitoring: National High Priority
- Key Components of Early Detection
- KLMN Research
- Bringing It All Together
- Anticipated Completion—Summer 2007
- Questions

NPS Inventory and Monitoring Networks



Purpose of Vital Signs Monitoring:

“The intent of park vital signs monitoring is to track a subset of physical, chemical, and biological elements and processes of park ecosystems that are selected to represent the overall health or condition of park resources, known or hypothesized effects of stressors, or elements that have important human values.”



Comprehensive

Invasive Species Monitoring



Prevention

Early Detection

Trends

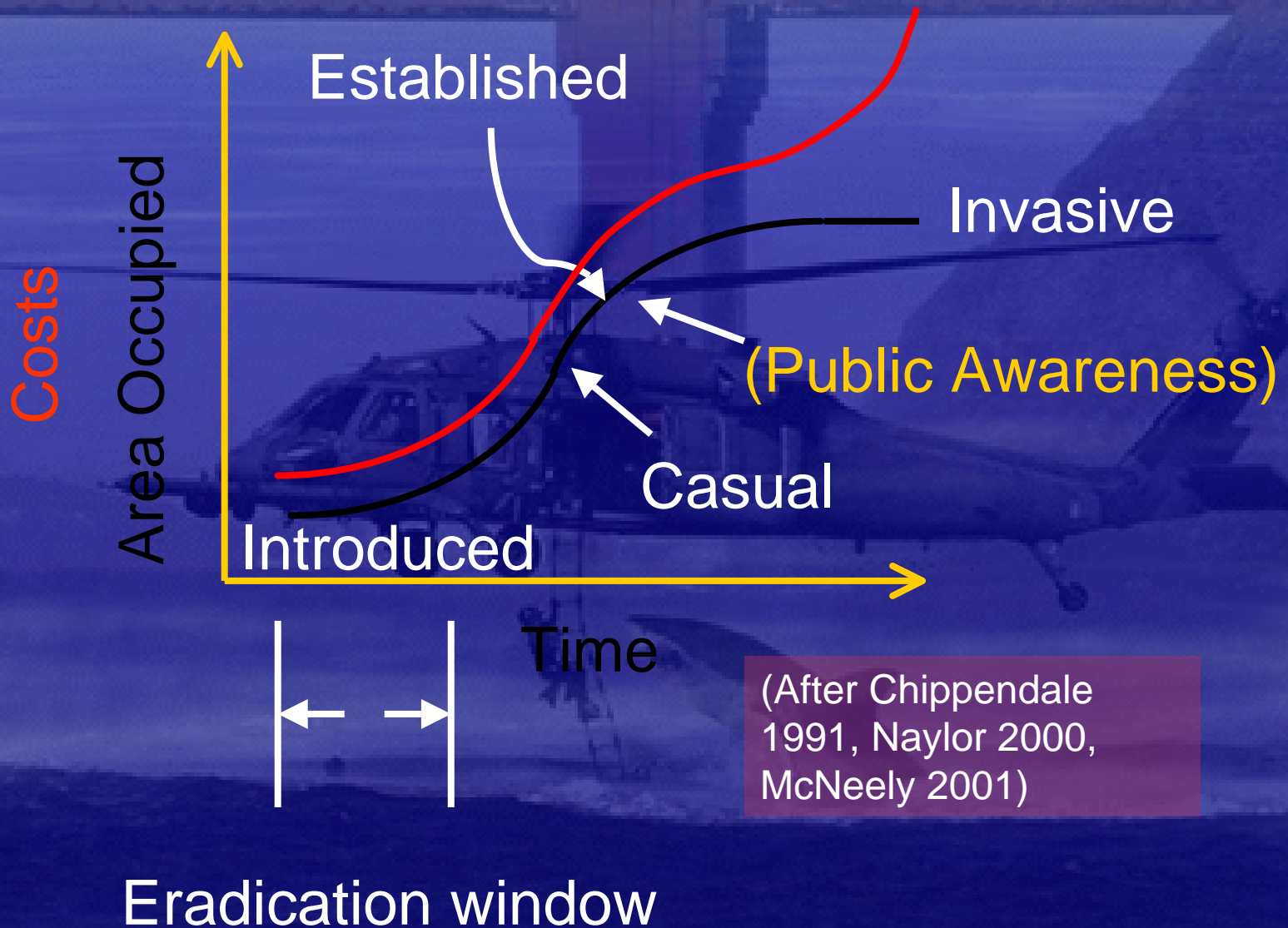
Efficacy of Management Actions

Secondary Effects of Actions

Restoration / Recovery



NPS Focus on Early Detection



8 Steps to Optimum Early Detection

Step 1. Develop a list of target species + resources.
Prioritize.

Step 2. Assemble known information.

Step 3. Risk of occurrence model (GIS) (using Step 2).

8 Steps to Optimum Early Detection (cont.)

Step 4. Develop an optimal search strategy (survey design).

Step 5. Use search model to direct search efforts.

Step 6. Record results and provide feedback.

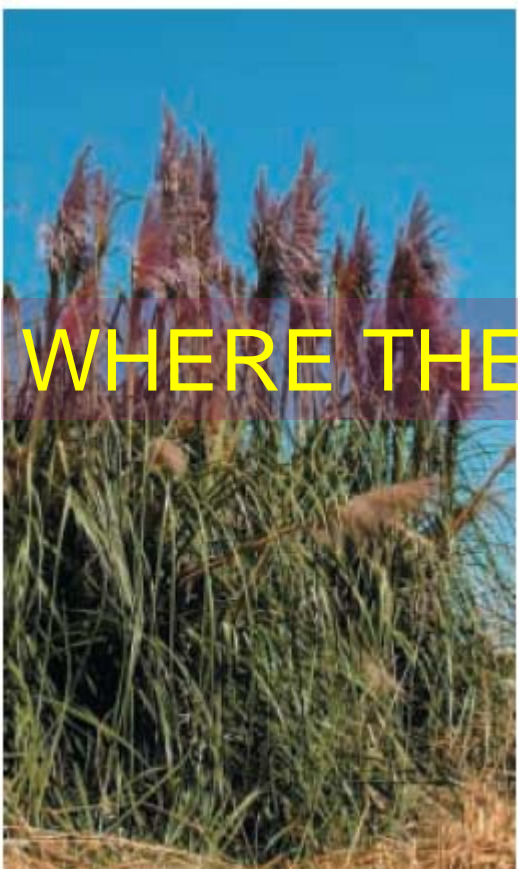
8 Steps to Optimum Early Detection (cont.)

Step 7. Analyze and report results.

Step 8. If one of the target species is found and cannot be controlled immediately, make arrangements for control efforts.



Welcome to the Klamath Network!



Redline Blue-bottle WTS
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WHERE THE NOXIOUS THINGS ARE...



Photo by Doug Johnson

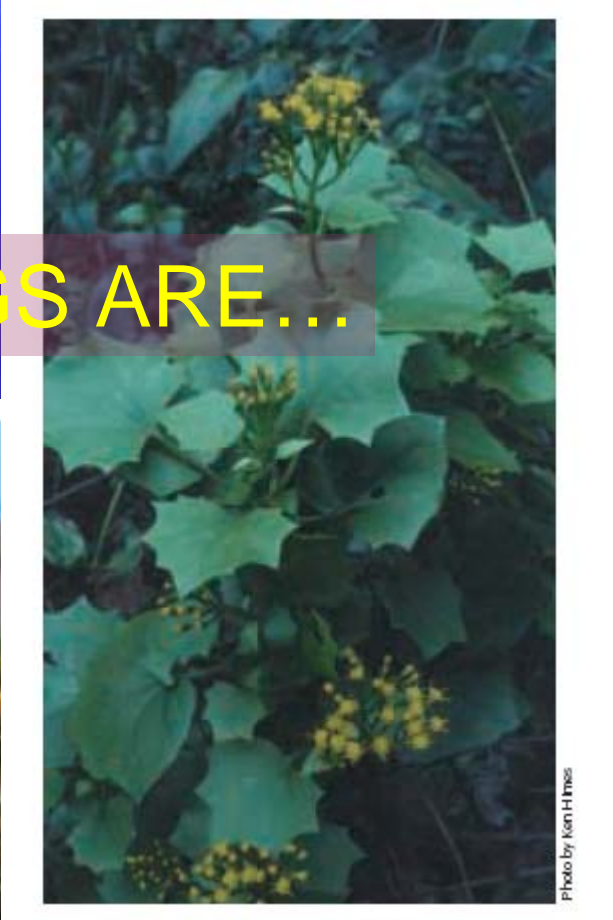


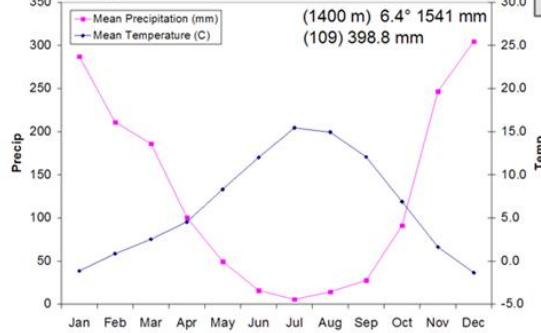
Photo by Ken Hines



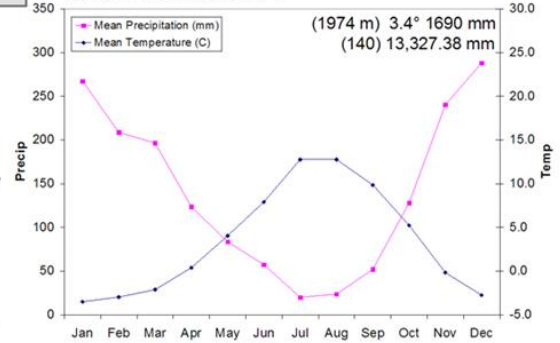
Climates of Klamath Network

Climate Diagrams (after Walter 1973) for selected stations in each park

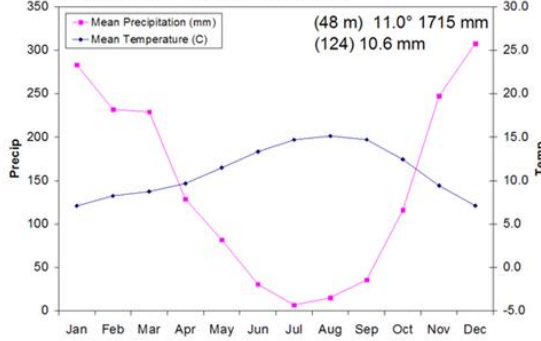
* Oregon Caves N. M.



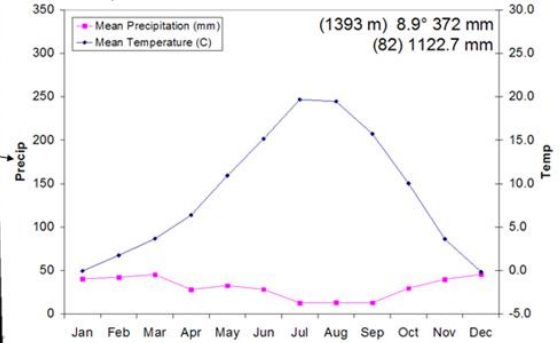
H.Q., Crater lake, N.P.



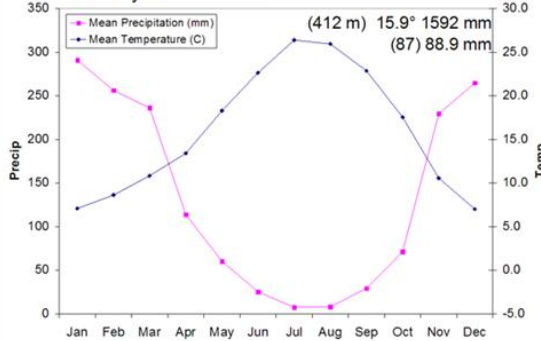
Orick, Prarie Creek Redwoods



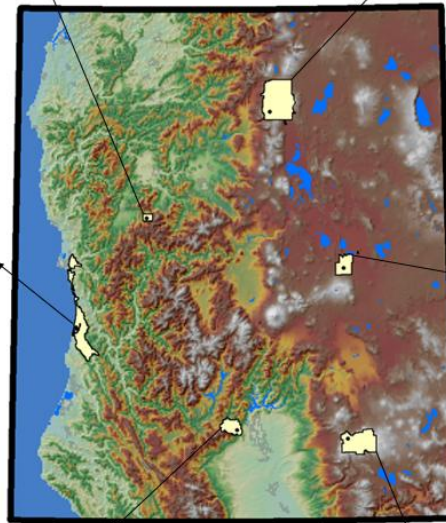
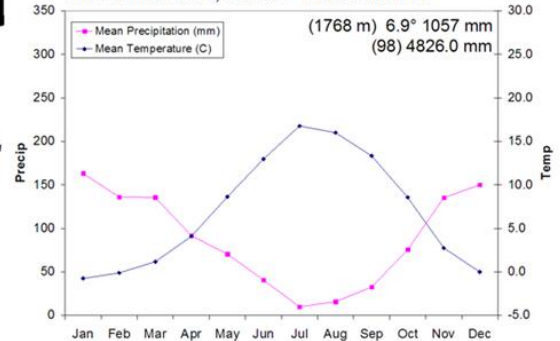
H.Q., Lava Beds N.M.



Whiskeytown N.R.A.



Manzanita Lake, Lassen Volcanic N.P.



National Park Service

Prepared by: Andrew Duff

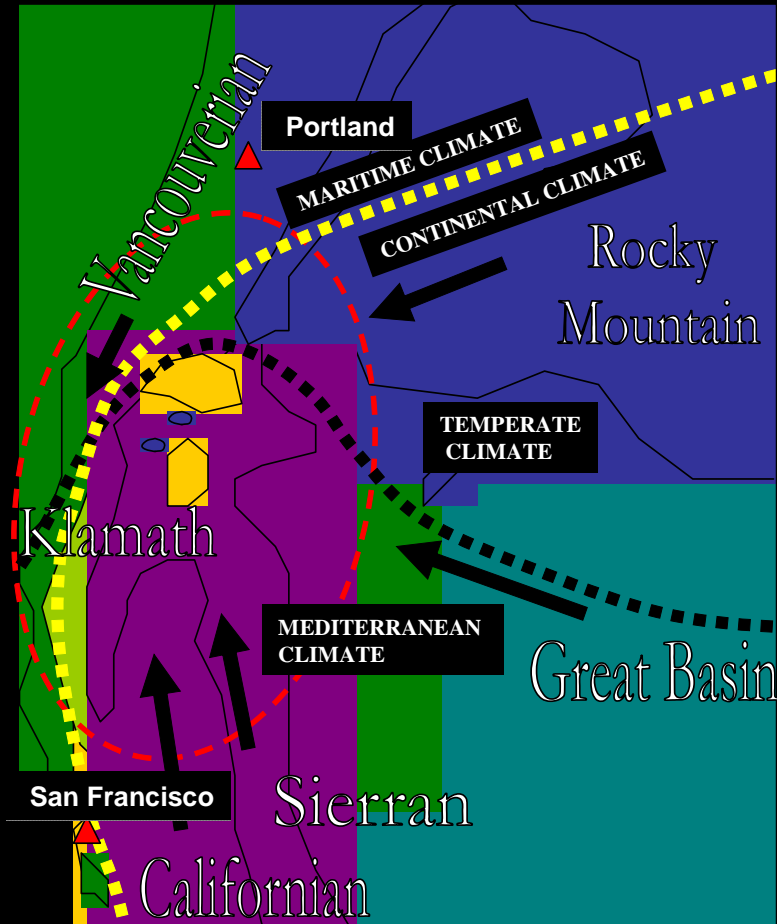
Why the Klamath Network?

Plant Geography of the Klamath Region

Mitchell (1976)
Air Mass Boundaries

- ■ ■ ■ Winter
- ■ ■ ■ Summer

Mitchell, V. L. 1976. The regionalization of climate in the Western United States. *Journal of Applied Meteorology* 15:920-926.



Map diagram illustrating major floristic provinces influencing the Klamath Region of northern California and southern Oregon and the location of major air mass boundaries outlined by Mitchell (1976).

Major Terrestrial Habitats of the Klamath Network

| Vegetation Type | Park Unit | | | | | |
|--------------------------------------|-------------|-----------------|-----------|--------------|---------|-------------|
| | Crater Lake | Lassen Volcanic | Lava Beds | Oregon Caves | Redwood | Whiskeytown |
| Coastal Environments | | | | | | |
| Coastal strand and dune | - | - | - | - | C | - |
| Coastal Prairie | - | - | - | - | U | - |
| Coastal Forest | - | - | - | - | C | - |
| Low Elevation Environments | | | | | | |
| Redwood Forest | - | - | - | - | A | - |
| Mixed Evergreen Forest | - | - | - | C | C | C |
| Oak/Pine Woodlands* | - | U | - | U | C | A |
| Annual Grassland | - | - | - | - | - | U |
| Chaparral | - | - | - | - | U | C |
| Mid Elevation Environments | | | | | | |
| Mixed Conifer Pine | A | A | - | U | U | C |
| Mixed Conifer Fir | A | A | - | A | C | C |
| Montane Chaparral | - | U | - | U | - | U |
| Upper Montane Environments | | | | | | |
| Subalpine Forest | A | A | - | - | - | U |
| Montane Meadows | C | C | - | U | - | U |
| Alpine | C | A | - | - | - | - |
| Great Basin Environments | | | | | | |
| Sagebrush Steppe | - | - | A | - | - | - |
| Juniper Woodland/Savanna | - | - | A | - | - | - |
| Ponderosa Pine Woodland | C | U | C | - | - | U |
| Rosaceous Shrubland | - | - | C | - | - | - |
| Mesic and Hydric Environments | | | | | | |
| Riparian Forests | C | C | - | C | C | C |
| Freshwater Marsh | - | C | - | - | U | U |
| Seeps and Springs | C | C | - | U | C | U |
| Alkali Meadows | - | ? | - | - | - | U |



A = abundant
C = common
U = uncommon

Who?

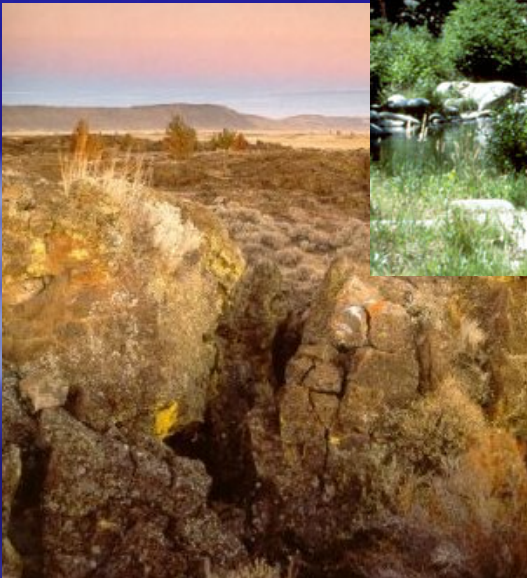
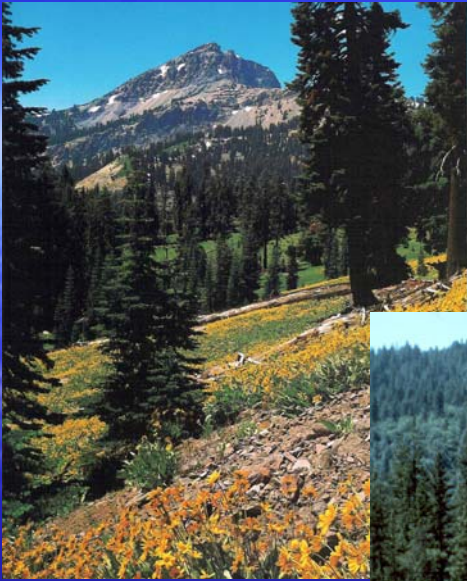


Klamath weed
Hypericum perforatum

Priority Weeds for Klamath Network Parks

| | |
|---|--------------------------------------|
| <i>Centaurea maculosa</i> | spotted knapweed |
| <i>Cirsium canadensis</i> | Canada thistle |
| <i>Lepidium latifolium</i> | perennial pepperweed |
| <i>Centaurea solstitialis</i> | yellow starthistle |
| <i>Cirsium vulgare</i> | bull thistle |
| <i>Euphorbia esula</i> | leafy spurge |
| <i>Lythrum salicaria</i> | purple loosestrife |
| <i>Senecio mikanioides</i> = <i>Delaria odorata</i> | Cape ivy, German ivy |
| <i>Spartina alterniflora</i> | Atlantic or smooth cordgrass |
| <i>Ulex europaeus</i> | gorse |
| <i>Ailanthus altissima</i> | tree of heaven |
| <i>Arundo donax</i> | giant reed, arundo |
| <i>Hedera helix</i> | English ivy |
| <i>Spartium junceum</i> | Spanish broom |
| <i>Leucanthemum vulgare</i> | ox-eye daisy |
| <i>Genista monspessulana</i> | French broom |
| <i>Verbascum thapsus</i> | woolly mullein |
| <i>Hypericum perforatum</i> | common St. John's wort, Klamath weed |
| <i>Halogeton glomeratus</i> | halogeton |

Where?



Where?

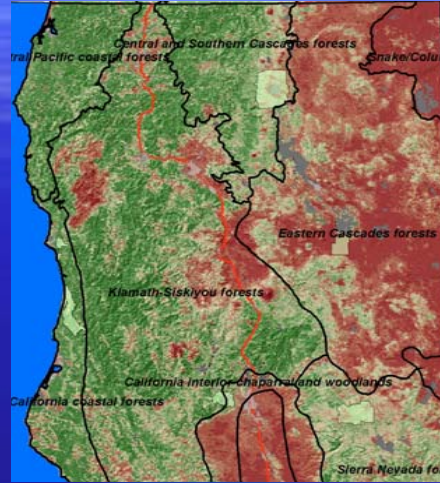
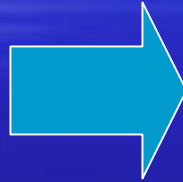
Which species are in region?

Which species constitute an immediate threat?

Ecoregional or Park-specific approach

Klamath World Wildlife Fund Ecoregions

Regional
Invasive
Species
Pool



Ecological Filters
(Ecoregional Climate, Soils, etc.)

**Ecoregion-
Specific
Rankings
of Most
Invasive
Plant Species**



| | | |
|-----------|-----------|-----------|
| Species 1 | Species 1 | Species 1 |
| Species 2 | Species 2 | Species 2 |
| Species 3 | Species 3 | Species 3 |
| Species 4 | Species 4 | Species 4 |
| Species 5 | Species 5 | Species 5 |

When?



Canada thistle
Cirsium canadensis

Temporal questions with respect to non-native plant invasions

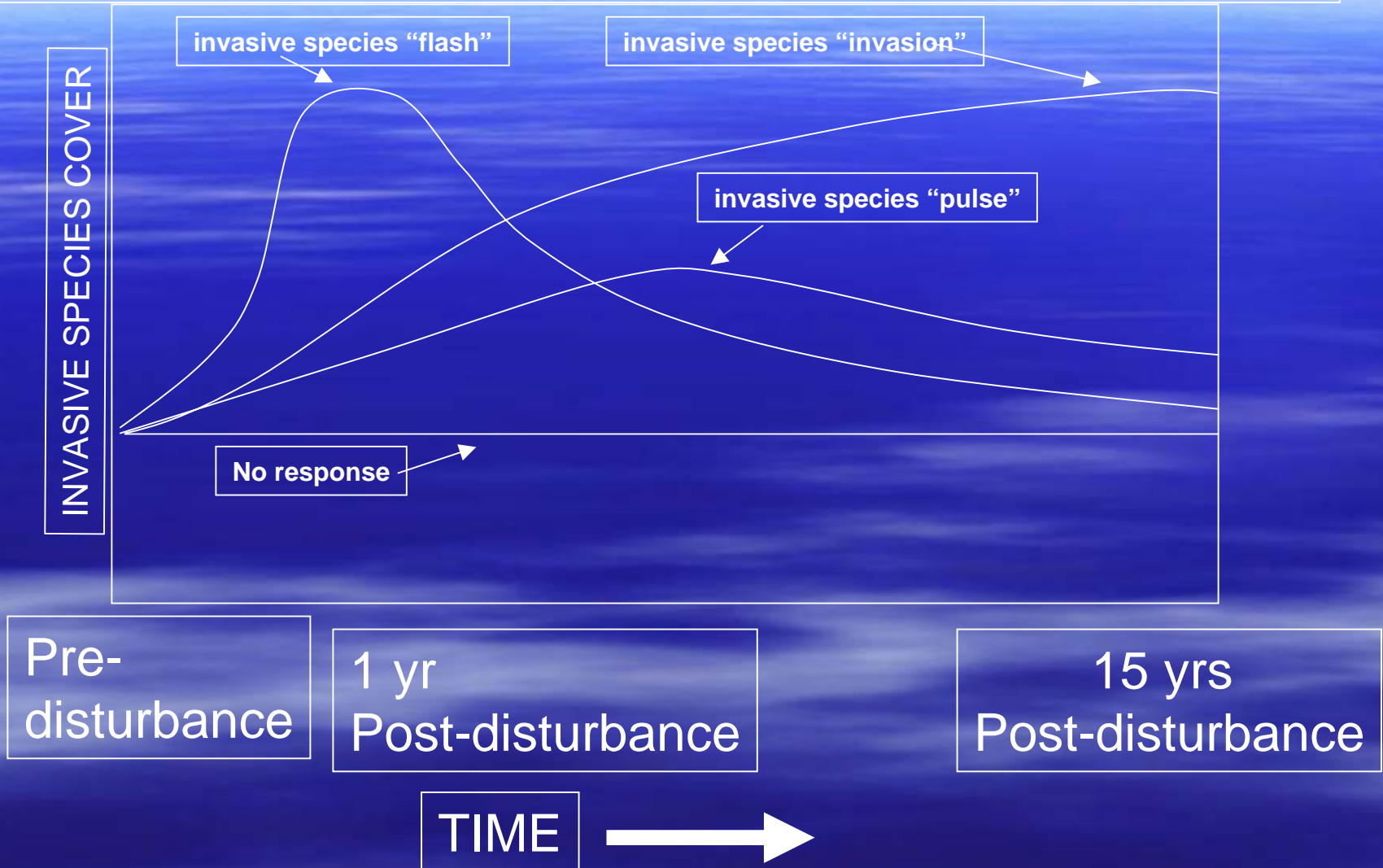
When do they invade?

How long do they persist?

How do they respond to management through time?

When

Tracking the establishment and spread of non-native species in park habitats



Three potential non-native species responses to fire disturbance.

**COMPETITIVE
CONTROLS**

**NON-NATIVE
SPECIES
COMPOSITION**

**SEED SOURCE
CONTROLS**

**ABIOTIC
CONTROLS**

Pre disturbance

**COMPETITIVE
CONTROLS**

**NON-NATIVE
SPECIES
COMPOSITION**

**SEED SOURCE
CONTROLS**

**ABIOTIC
CONTROLS**

1 yr Post-disturbance

**COMPETITIVE
CONTROLS**

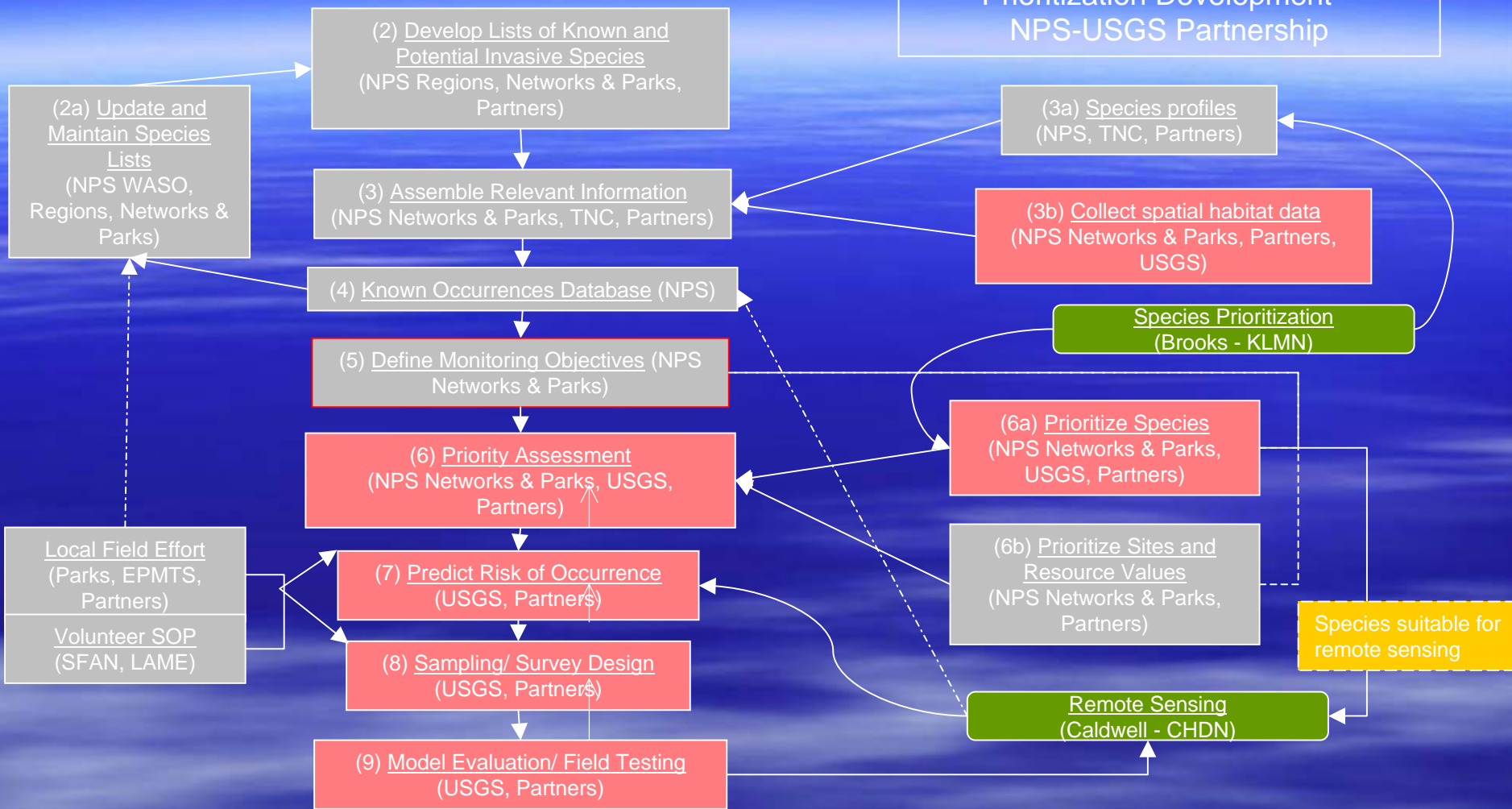
**NON-NATIVE
SPECIES
COMPOSITION**

**SEED SOURCE
CONTROLS**

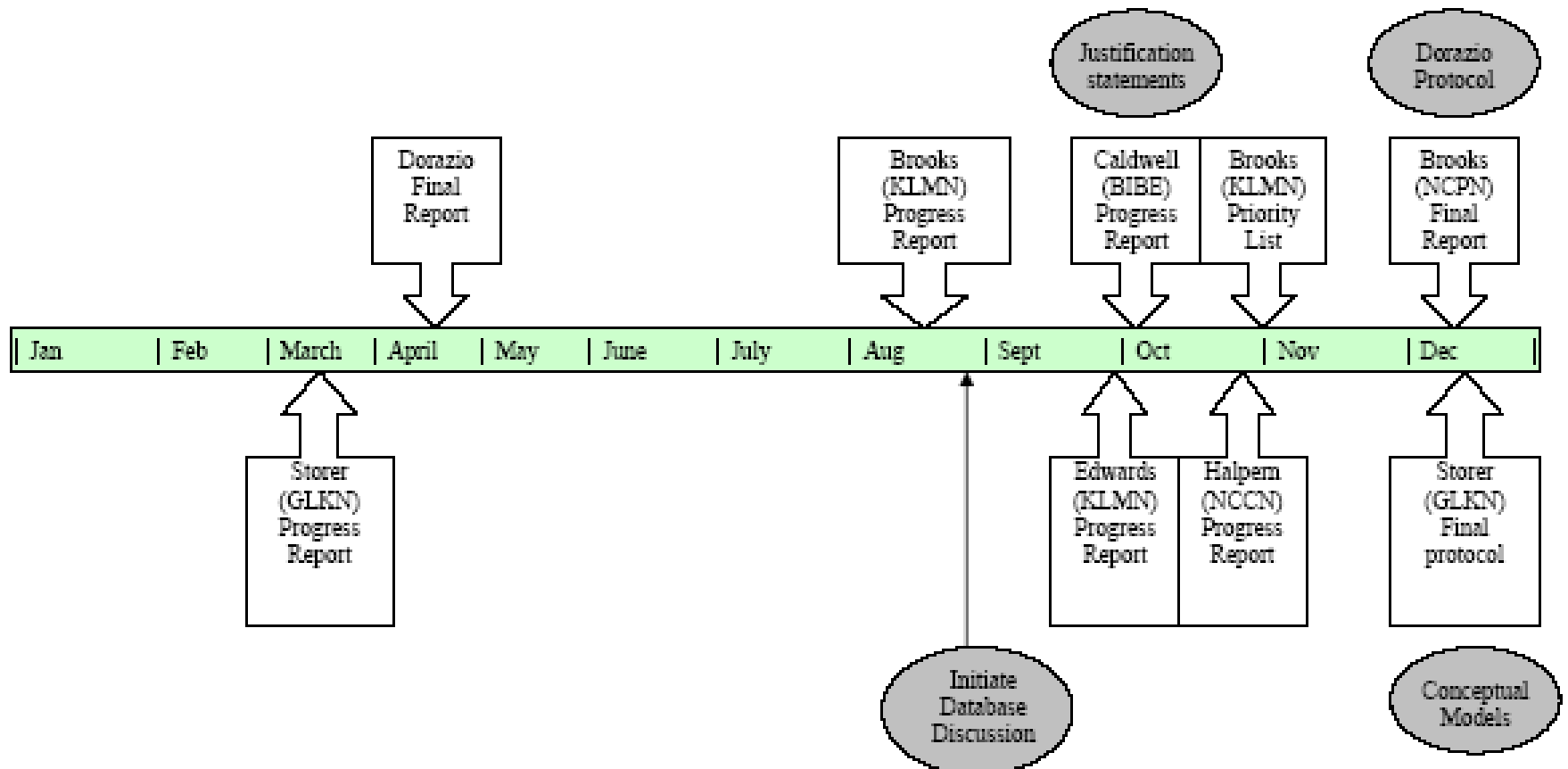
**ABIOTIC
CONTROLS**

15 yrs Post-disturbance

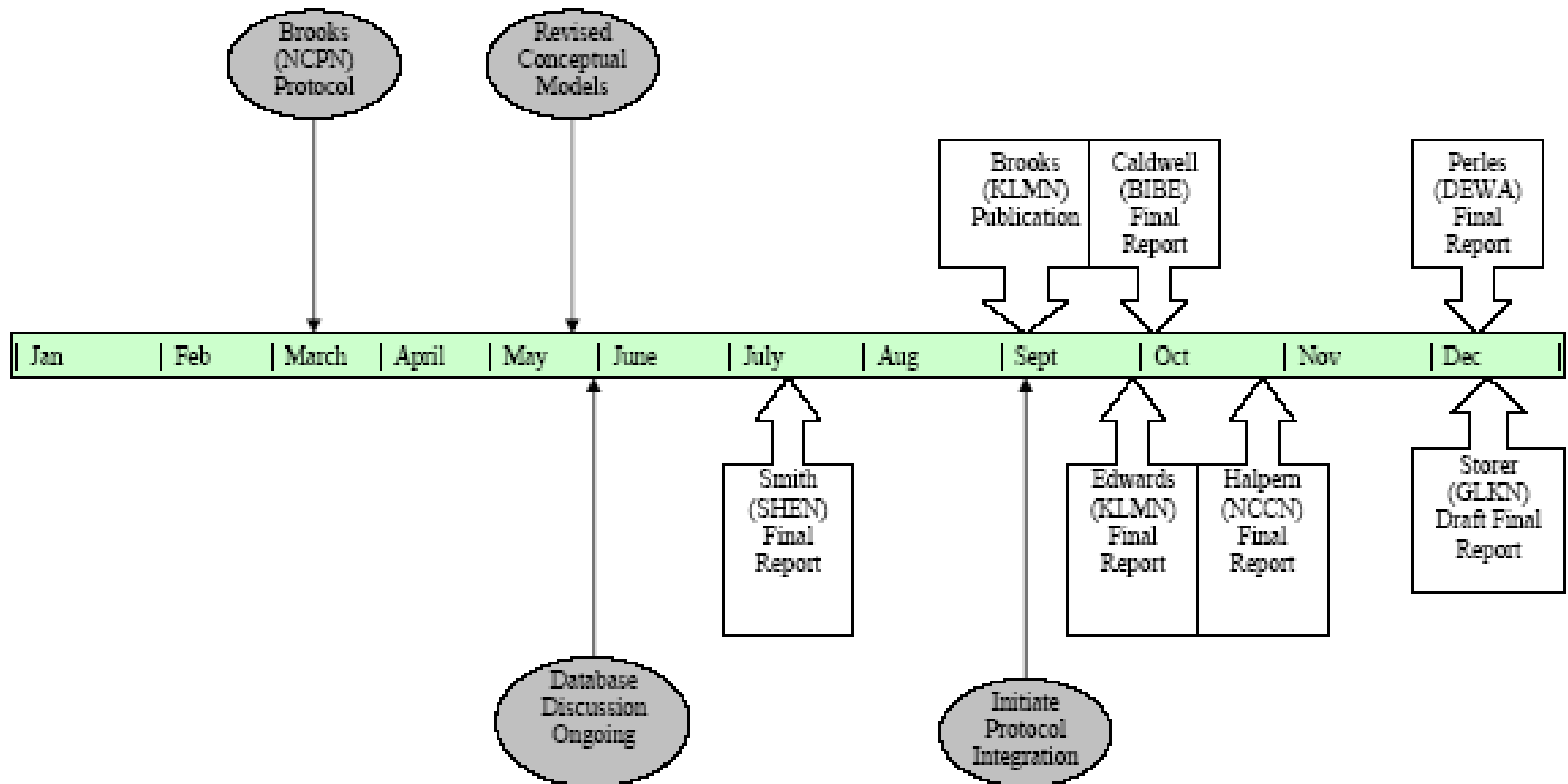
Early Detection Data Assembly and Prioritization Development – NPS-USGS Partnership



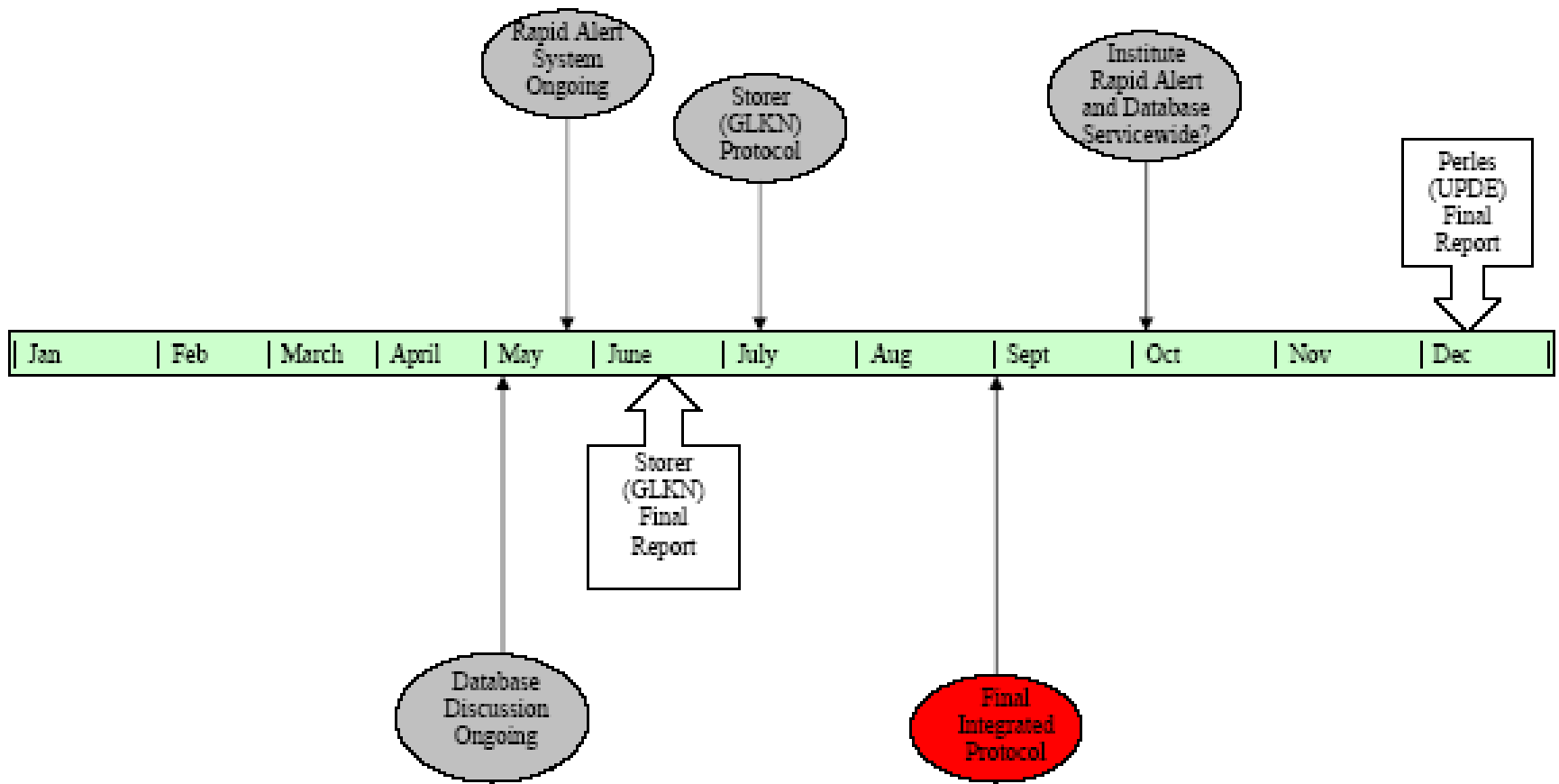
ISED Timeline 2005

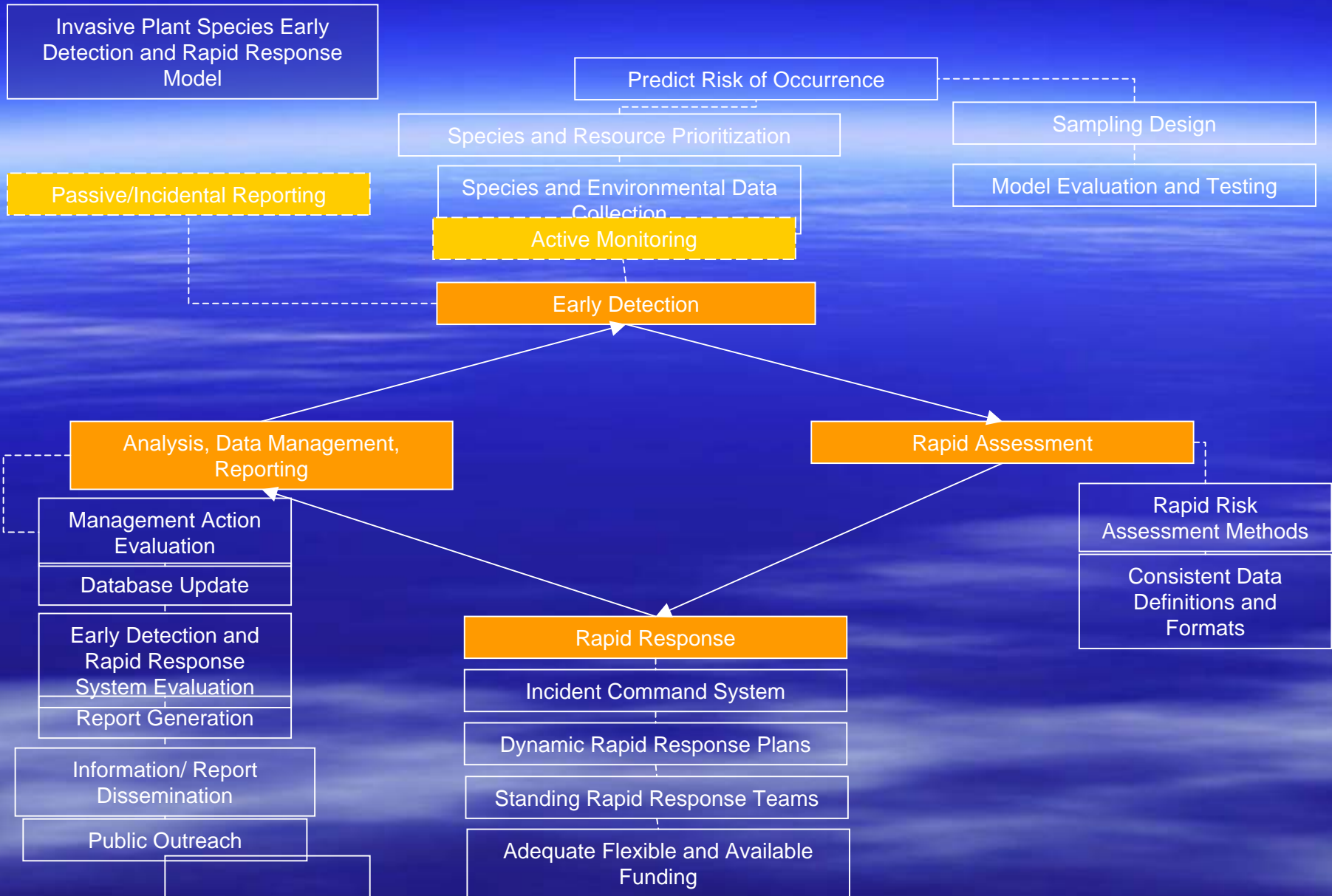


ISED Timeline 2006



ISED Timeline 2007





Key components and associated subtasks for an invasive plant species early detection and rapid response system.

Next Steps

**Project Integration to Form a
Comprehensive Invasive Plant Early
Detection Protocol**



Questions?

<http://science.nature.nps.gov/im/monitor/invasives.htm>