Phenology & Citizen Science Go Mobile
Developing Mobile App Technology

- Background
- Role of Mobile Apps in Cit-Sci
- Demo
- Phases of Development
- Open Forum
- General Lessons Learned
- Conclusion
A New Data Source

Primary goal
Understand how plants, animals and landscapes respond to environmental variation and climate change and empower environmental leaders to act on that information.

Mission
• Make phenology data, models and related information available to scientists, resource managers and the public.

• Encourage people of all ages and backgrounds to observe and record phenology.
Need for Mobile Apps

Traditional Web Development

While it still has a place in the world, ubiquitous technology is making traditional web apps less and less useful.

Short Comings
- Grounded
- Complicated
- 3rd Party Interference
- Boring!
Need for Mobile Apps

Mobile is the future!

- Field Data Collection
- Ease-of-Use
- Accessibility
- Broad Appeal
So, You Wanna Make a Mobile App...

Breaking down development into iterative, distinct phases, with an emphasis on **planning** will save time in the long run.
App Development – Planning Phase

Things to consider

• Target Audience
• Platforms to Support
• Functionality
• Cost
• Infrastructure
• Scheduling
Planning Phase – Target Audience

- Broader audience with more ‘user-friendly’ needs
- ... or internal use, ‘deal-with-it’ design approach

Considering the affiliation and technological experience of your end users will affect functionality needs.
Planning Phase – Supported Platforms

Android vs. iPhone vs. Blackberry vs. the-next-big-thing

May only have funding and/or time to support one or the other.

Depending on your needs and resources, you may not have to choose!
What does the app DO?

- Storyboarding
- Determining Business Rules
- Develop Database Schema

This is probably the most critical part of the entire development process! Fixing a problem here is ~3x more efficient than fixing it later in development.
Planning Phase - Cost

How to Pay for This?

- In-House Development will likely be slower, but cheaper
- Outside Contractor is more money, but very effective
- Hybrid Approach

Average Pay Rate for Mobile Developers

- Android - $35 – $60 / hour
- iPhone - $75 - $150 / hour
Planning Phase – Infrastructure

Apps May Involve More Than Just a Phone

- Database Interface
- Local (phone) database
- Off-line processing

Interfacing with systems outside of the phone is complicated, and the cost needs to be considered, head-on.
Planning Phase - Scheduling

- Development Time
- Testing / Deployment
- Setbacks

Like any software development, it will almost definitely take longer than you think. If you have a deadline, plan accordingly.
Planning Phase – Paperwork Reduction Act

Mobile Data Collection is Not Withstanding!

If collecting data from more than nine people in the public, you must be in compliance with the paperwork reduction act.

- OMB Number takes 6 to 9 months to obtain
- Needs to be renewed every 3 years
- Acquired through explaining why the form is purposeful, and estimating data collection time commitment
Discuss!

- What kind of planning steps do you currently take when preparing for new projects?
- What other things might you try to plan for if developing your own mobile app?
App Development – Design Phase

General Advice

• Do it!
• Do it well; hire a designer.
• Let the graphic designer do her job!
Where the Platform Matters

- Different Platform – Different Language
- Irks
- Perks!
Objective-C

Irks:
- C like memory management
- No namespaces
- Virtual folder structure
- Requires a Mac.
- $100 application fee
- Fewer developers available for hire

Perks:
- Less platforms / versions to code around
- Aesthetically pleasing default design
- Uses Core Data to abstract database interaction
Development Phase - Android

- Java
- Irks:
  - Emulator tool is weak – very slow
  - Must support many different platforms / firmware versions
  - Programmers overly abundant?
- Perks:
  - Developer tools are easier to use
  - Community is more open sourced, friendly
  - Multiple IDEs available for development
Development Phase - Cross-Platform Options

Myriad Options

- HTML5
- Javascript
- .NET / C#

- In theory, should save loads of time
- May not be appropriate for some applications
- May be additional costs involved
In many respects mobile development is not unlike traditional software development.

- MVC structure is prevalent
- Folder structure is very typical (Android)
- Having target platform available for testing is invaluable
Interfaces and Infrastructure

No (good) App is a Rock!

- Your Own Database
- Google Services (maps)
- Social Networking
- Security

It’s important to consider early-on which of these are relevant to your app.
How to Phone Home

• Try to find phone-database drivers?
• Setup an App Server
• Setup a true Web Service

Any kind of data collection apps likely need to send that data to a repository, but doing so is not as easy as connecting to a traditional database.
A web service acts as an intermediary between your app, deployed (hopefully) to many users, and the database.

- Greater Security
- More abstraction
- More flexibility
- Interoperability
- Improved data quality
- Shared code = saved time

- Multiple protocols from which to choose (SOAP, REST)
- Language Independent
Wear that Albatross!

- Longer, initial development
- Another ‘thing’ to maintain
- Interfaces must be well-defined early on
- Documentation is a pain
- More ‘face-time’ needed between mobile developer, web service developer
If your app is to reliably record data, you must provide a means to handle scenarios when the user is out of network.

Possible Approaches
- Constant synchronization
- Bulk Upload / Download
- No network connectivity required
Android has native support for maps!

iPhone HAD Google maps as native provider

Irrelevant to developers – intermediary package, MapKIT, is used in iOS development

Can still use Google Maps on iPhone

If you are collecting data in the field, you will probably want some type of mapping feature.
An Oft Ignored Need

Authentication / Authorization
- OAuth
- Custom Scheme

Confidentiality
- Encryption
- HTTPS
Authentication and Authorization

OAuth
- Industry standard protocol
- A pain to setup and configure
- Extremely Confusing

Using custom authentication/authorization requires an experienced programmer.
Confidentiality

Any sensitive communications need to be encrypted. Long-standing, industry standard is HTTPS. Not without complications, however:

• Acquiring a valid certificate costs money
• Slows network communication
• Many mobile platforms don’t contain CA certs by default
• Complicates international distribution (iPhone)
The Outside World

A great/easy way to promote a cit-sci program.

- Aforementioned OAuth required to use these services.
- For generic OAuth clients there are open-source solutions
  - Signpost (Java)
  - GTM-OAuth (Objective-C)
- Most services provide interfaces to their APIs for popular programming languages.
Discuss!

- What difficulties have you had interfacing with other organizations?
- What complications do you foresee in your own existing infrastructure?
- In an ideal world, how would you like to share data and communicate via social networking?
App Development – Testing Phase

- Automated Code Testing / Unit testing
- Use case testing
- Free-form testing
- Test on multiple versions of software/hardware

Don’t overthink testing – better to do some than none!

Consider general feedback in addition to technical errors.
Testing – iPhone vs. Android

Android
Simply generate the file and distribute it to beta testers!

iPhone
Register a test version of the app, along with unique identifier of all beta testers’ phones, create provisioning profiles for each user, etc, etc.... to reasonably conduct this requires Test Flight.

• Invite users to test app
• Users automatically registered
• Provides metrics and crash reports

Success! Deployment, however, is very specific to the platform for which you’ve developed.
Much simpler for Android developers

- Google provides a signed certificate to developers for authorizing apps
- Android SDK developer console has a tool deploying apps, where app name, description are completed
Apple complicates this process

- Initial App, when submitted, must be approved by Apple
- Subsequent updates to app, also require Apple review and approval
- International distributions of an app using encryption requires an Exporter Registration Number and approval from the NSA (National Security Agency)
- Deployment is done through the iTunesConnect tool, part of the iOS SDK
- Apps must be built as a deployment version rather than a debug version, used during development

Reasons for an App to be Rejected

• Replicates existing functionality
  • Easily confused, if your app launches a web page.
• Lewdness, ridiculing public figures
• Dramatically deviating from standard aesthetic design
• Icon size is wrong
• Version number < 1.0
• Inappropriate keyboard input type
• Not able to handle lack of connectivity
• A myriad more, arbitrary reasons...

Schedule additional time for app approval. Count on a week for each deployment, a month for initial approval if you suspect being rejected.
Google Play & iTunes are main venues for advertising mobile apps.

- Notifying users via email mailing list
- Posting links on organization website
- Disseminate QR Code
- Social Networking, e.g. Facebook, Twitter

Feedback has told more about target audience than vice-versa.

Don’t be afraid to seek out feedback.
• Don’t try and do everything (at first).
• Do try to support multiple platforms if possible.
• Do thoroughly plan things out well ahead of time.
• Do test thoroughly.
• Do try to build your infrastructure in addition to your apps
• Don’t expect your app to cure cancer.
Conclusion & Thanks