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**The Environmental Observation Web and its Service
Applications within the Future Internet**

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D1.4.2 Pilot applications for Biodiversity Scenarios II

Guidelines document

EAA

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Glossary

The glossary of terms used in this deliverable can be found in the public document “ENVIROFI_Glossary.pdf” available at: <http://www.envirofi.eu/>

Abbreviations and Acronyms

Abbreviation / Acronym	Description
GEO	Group on Earth Observations
GEOSS	Global Earth Observation System of Systems
GMES	Global Monitoring for Environment and Security
FI-PPP	Future Internet Public-Private Partnership
INSPIRE	Infrastructure for Spatial Information in Europe
OGC	Open Geospatial Consortium
OMG	Object Management Group
REST	Representational State Transfer
RM-ODP	Reference Model for Object Distributed Processing
SDI	Spatial Data Infrastructure
SOA	Service Oriented Architecture
SoS	System of Systems
SoSE	System of Systems Engineering
SWE	Sensor Web Enablement
UML	Unified Modelling Language
VGI	Volunteered Geographic Information
VP	Viewpoint
W3C	World Wide Web Consortium
XML	Extensible Mark-up Language

Table 1. Abbreviations and Acronyms

Executive Summary

Biodiversity is essential for human wellbeing; only by guaranteeing a well-balanced ecosystem can we assure a healthy and sustainable future for all life on this planet. The target of halting the loss to biodiversity by the year 2020, set both by the UN Convention on Biodiversity (CBD) and the EU, requires biodiversity observation data to provide a solid basis upon which to judge this progress as well as to assess the efficacy of measures for the protection of biodiversity. Observational data on biodiversity occurrences must be merged from all available sources while assuring high quality data and providing uncertainty measures where applicable. To do so we must leverage the potential of outreach groups for data survey, thus widening the base from which observational data may be gleaned. In order to utilize this new wealth of data we must also develop other forms of quality assurance in order to properly benefit from this additional contribution to biodiversity research. In addition, through a stronger engagement of non-scientists, we heighten the understanding of biodiversity related matters in the general populace.

The ENVIROFI-Bio app, created by ENVIROFI work package 1 (WP1: Bringing Biodiversity into the Future Internet), focuses on the use of Future Internet technology for survey, analysis, quality assurance, persistence and dissemination of biodiversity data. This enables users from a wide variety of backgrounds to:

- Obtain information on interesting biodiversity occurrences recorded directly at their current location
- Provide information on biodiversity occurrences they are currently observing
- Provide feedback on the correctness of existing biodiversity occurrence records in the system.

1 Introduction

Biodiversity is essential for human wellbeing; only by guaranteeing a well-balanced ecosystem can we assure a healthy and sustainable future for all life on this planet. However, to do this, we must understand the intricate interactions between the flora, fauna and fungi populating this world. As an initial step, we must perform exacting surveys on the current status of biodiversity in order to determine where which species currently still exist and in what abundance they occur.

Due to budget cuts entailed by the financial crisis, fewer resources are available for scientific and governmental surveys; it is just not possible to perform the necessary surveys to the required level of detail. Thus, the ENVIROFI-BIO app is working to fill this gap, providing means to leverage the interests of nature lovers and enabling them to support this important work.

In addition, users are provided with interesting information on biodiversity at their current location. This can be an interesting complement to more traditional field guides, as it allows for interactivity with the information provided. Also, in a world where peoples interest is progressively focused to the horizon of their smart phone, by bringing biodiversity into the smart phone, we hope to in turn bring the users back out into nature. Only through a thorough appreciation of the wonders of nature can the necessary enthusiasm be found to be willing to save this wonderful world around us.

2 Links to prototype

The ENVIROFI-BIO prototype App, which has been developed within the ENVIROFI project, can be accessed using an Android device. In addition, we have provided various types of documentation on the use of this app.

2.1 ENVIROFI-BIO App

The ENVIROFI-BIO application is currently designed to run only on the Android platform. Due to technical constraints, it currently only functions stably on Android version 4.1 and 4.2; in future releases this will be extended to cover other Android versions as well as other software platforms.

Please note: this is currently not a commercial application and thus requires additional steps to install compared to most phone applications; please follow the instructions carefully.

The ENVIROFI-BIO App can be downloaded from the ENVIROFI online catalogue, Section “Applications / Bringing Biodiversity into the Future Internet / Downloads” (<http://catalogue.envirofi.eu/>).

2.2 Demonstration Webcast

This visual demonstration is intended to provide an overview of the ENVIROFI-BIO App to interested individuals. It may be used as a tutorial for the ENVIROFI-BIO App or also as a demonstrator for presentations or for situations where a live demonstration is not possible.

To make this webcast, we created a series of PowerPoint slides that addressed the various background requirements that led to the creation of the ENVIROFI-BIO App, which we then merged with a narrated voice over.

The online Webcast demonstrating the background to the application and a walkthrough of its functionality can be viewed here in section “Applications / Bringing Biodiversity into the Future Internet / Documentation” on <http://catalogue.envirofi.eu/>.

2.3 Paper Documentation - Guidelines document

Information on the prototype is provided by a guidelines document (this document) in PDF Format from the following location:

http://www.envirofi.eu/Portals/89/Docs/Project/Public_deliverables/D1.4.2_Biodiv_V2.pdf

3 Guidelines to Users

3.1 Getting started

Read this guidelines document prior to using the online version of the ENVIROFI-BIO App, or installing it to your phone. This is useful in order to have a good understanding of what it can do, and how it works.

3.2 Installation

As a new user of the ENVIROFI-BIO App, you must first install the application. If you have already done this skip to the next section.

To install the application, please follow these steps:

- First of all, go to the ENVIROFI catalogue and download the latest version of the app via the QR code (using a QR code scanning app which you can obtain e.g. from Google Play Store) to your phone. Please note that the ENVIROFI-BIO App is currently available in English, German, and Italian. The language of the app is provided within the link.

As an alternative you can also enter the application link into an internet browser window on your PC to download the app first to your PC and then via cable to the phone. Once you have downloaded the App, make sure the file extension is ".apk" as some browsers modify the extension to ".zip". Then connect your phone to your computer, activate the USB storage and copy the application to a folder of your choice (i.e. "Download").

- If you have used the download procedure via PC, as a next step, you must download and install the Astro File Manager from Google Play Store:

https://play.google.com/store/apps/details?id=com.metago.astro&feature=search_result

Once the file manager app has been installed, start it, navigate to the folder where you have saved the previously downloaded application, and tap on the icon to start the installation.



Figure 1: Application Icon in File Manager

- It might be that the following message occurs. If so, click on "Settings" and enable the "unknown sources" option as shown in the picture.

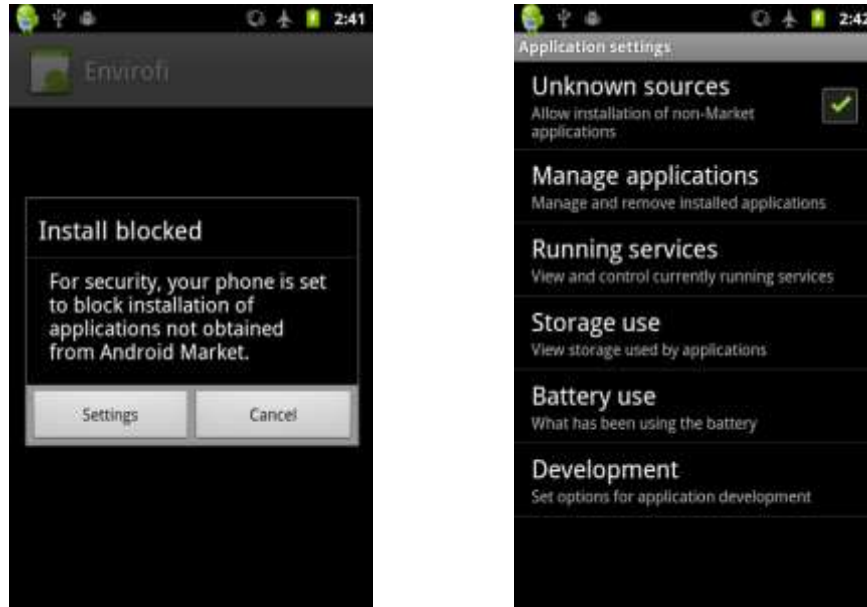


Figure 2: Allow Installation of non-Market Apps

- Go back to the Astro File Manager and install the ENVIROFI-BIO application. After installing you can find "ENVIROFI-BIO App" in the program menu with all other installed applications.

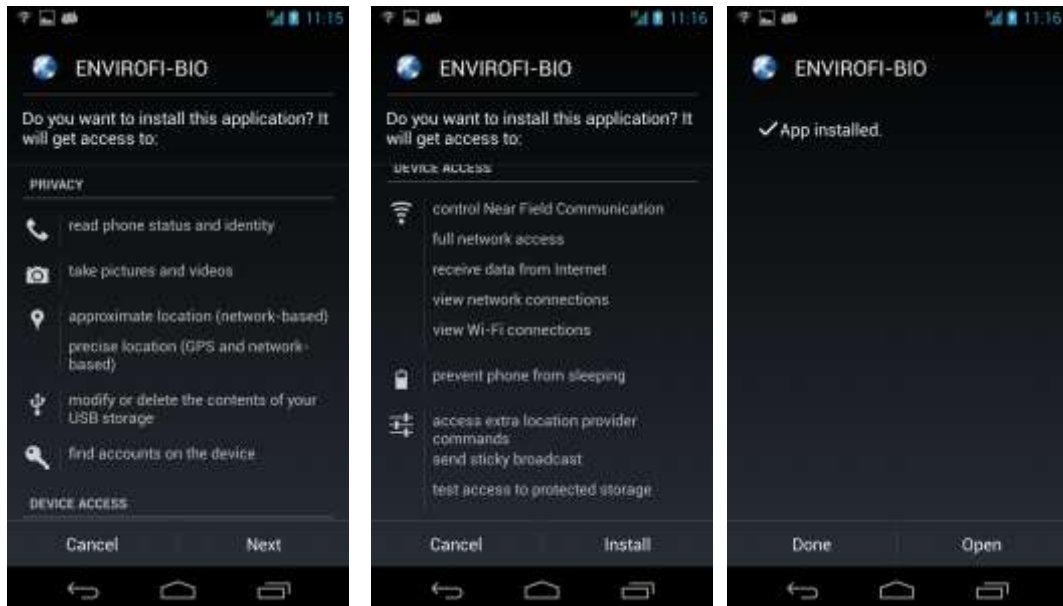


Figure 3: App Installation

3.3 App overview

This section describes the user interface of ENVIROFI-BIO in detail.

3.3.1 Login

When starting the application, a login screen is displayed containing the application logo and version number and controls to enter user credentials. These user credentials are used to identify the provider of occurrences and observations within the geo-referenced observation collecting and visualizing system. Furthermore, the user credentials can be used for authentication and authorization against any internet services accessed by the application or by the background server.



Figure 4: Login screen

3.3.1.1 Phone Account Login

ENVIROFI-BIO supports phone accounts of the following providers:

- Google
- Facebook
- Twitter
- Yahoo
- LinkedIn
- Skype

On the login screen there are only account types and accounts provided which are stored on the phone (except the demo user accounts, see below). To login, you have to select the account type and the account name. Pressing the login button starts the application.

The user name and account type is recorded with new observations as observation provider. Furthermore, the areas of interest defined by a user are assigned to this identity and the data which shall be displayed within these areas of interest are synchronized between client and server (for “areas of interest” see chapter 3.3.5 below).

3.3.1.2 Demo Login

For demo purposes it is not necessary to login with a registered account. When selecting account type “Demo” you can select between two accounts: demouser1 and demouser2. No check against any identity management is done. You have to be aware that other users who log in with one of the demo ac-

counts can define e.g. large areas of interest and the synchronization of this data can be time- and bandwidth-consuming.

3.3.2 Main Menu

The main menu contains three buttons for choosing the main functionalities of the application:

- Settings
- List Observations
- Areas of Interest

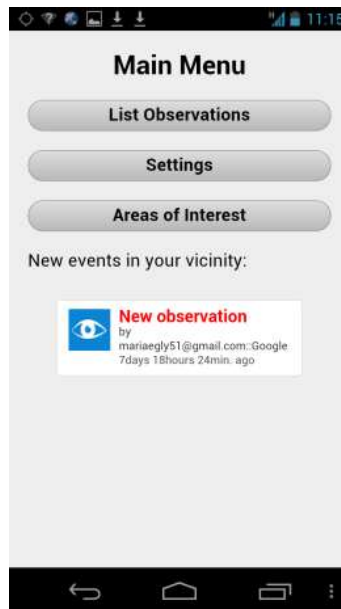


Figure 5: Main menu

Furthermore, a list of the latest events, which are relevant for the user and have not yet been opened by the user, is displayed at this screen. Events are generated by the system whenever a user reports a new occurrence or a new observation for an occurrence and an area of interest of another user is affected by this report. The amount of events displayed in this list is initially limited to five but can be changed in the settings dialog (see chapter 3.3.3). Tapping on an event will open the details view of the object to which the event is related.

The list of events is sorted by the distance between the current position of the mobile app user and the object which is affected by a particular event. When the user is moving, i.e. the position of the mobile phone changes, the event list is updated according to the new situation.

3.3.3 Settings

Following settings are provided:

- The user name is displayed
- A user can switch “Use GPS Sensor” on and off and edit the default GPS coordinates. The button “Center Map to Current Position” (see 3.3.4.1) centres the map to the user’s current GPS position resp. to the position entered here as default position.
- “Select Map” provides a list of map tile servers which can be used for visualizing map data. Currently, there are map tile servers available for the regions of Vienna/Austria and Tuscany/Italy. Outside of these regions OpenStreetMap should be used as map server.

- New occurrences and observations entered by a user are visible for other users only if “Publish new observations” is set to true.
- When “Google Notifications” is switched on, events will not only be received via the application’s event mechanism but also via Google Cloud Messaging (GCM). The mobile application will be subscribed to GCM when this setting is on and events are sent from the server via GCM to the mobile phone and appear as Instant Messages on the phone’s screen.
- “Use local Maps” defines globally for the application that the graphic map tile files for visualizing map data shall be loaded from the phone’s local storage instead of a remote map tile server (selected by “Select Map” – see above)
- “Events in Main Menu” defines the length of the event list displayed on the main menu screen. Default value is 5, which can be changed using this control.
- For test purposes and to analyse application bugs, there are various log levels provided which can be selected via the button “Log Level”:
 - Error
Only errors messages are written to the log file
 - Warning
Error and warning messages are logged
 - Info
Errors, Warnings, and Infos are logged
 - Debug
Additionally to errors, warnings, and infos there are debug messages written to the log file.

Default value is “Error”. You have to be aware that the logfile stored on the phone’s memory can increase to a large size when you set a higher log level.

- “Upload Report” is a button which you can use to upload the log file to the server. This should only be executed after getting in contact with an application developer, because (s)he shall be informed that the file will arrive at the server and can be analysed for errors. When a log file is sent to the server, it will be deleted at the phone.
- “Restart Synchronization” re-initializes the synchronization process between the mobile client application and the data collection server.
- “Delete Cached Maps” will delete all maps which have been stored locally on the phone’s file system when any areas of interest were specified. If the data volume of stored maps is large enough, you will see that the total memory available on the phone will increase after deleting the cached maps (compare Settings/Memory/Total Memory Available before and after deleting the cached maps).

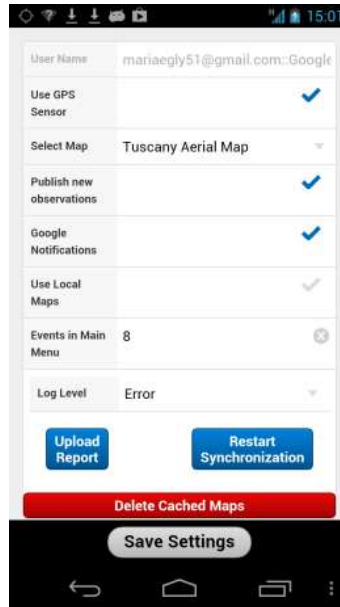


Figure 6: Settings

3.3.4 List Observations

Tapping on this button in the main menu will lead you to a screen where a map is displayed which is centred on your current position. To see any occurrences available in this area, you have to specify an area of interest as described below.

To prevent downloading large amounts of data from online servers, the user will be asked if (s)he agrees on downloading at any stage of the application where this can be a problem regarding high network expenses. E.g., each time, when the map view shall be displayed, a notification pops up where the user can decide if the maps to display the areas of interest shall be downloaded from the server or if (s)he prefers to use only the maps cached on the phone.

The chapters following will describe the functions for displaying occurrences and observations and entering new data into the system.

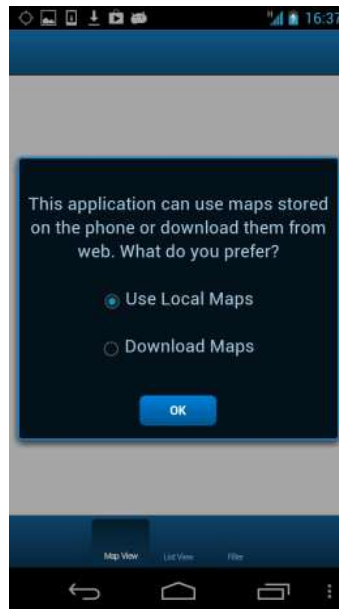


Figure 7: Choose local or remote map

3.3.4.1 Center map to current position

The button on the right bottom corner of the map is displayed when the map is not centred to your current location. Tapping on this button will set the map centre to your current location again after moving, panning, zooming the map, or jumping between areas of interest (see 3.3.4.2 below).

3.3.4.2 Define Area of Interest

To define an area of interest you have to tap on the cross button in the bottom right corner of the map. A rectangle will be displayed on the screen where you can position the area you are interested in. You can use the pan and zoom functions to adjust the area. Tapping on the “Cancel” button will discard your inputs, tapping on “Save” will store the area you defined. Before the area is stored on your phone you are informed about the estimated data volume of the maps and the occurrence and observation objects you are going to download. Here you can finally decide if you want to download the data necessary for your area of interest or if you want to abstain from storing the area in order to save download bandwidth. When you agree, you will be asked to enter a name for the new area of interest and the map and data get downloaded from the server and stored on your device. The progress of the download process is indicated by a load mask displaying the percentage of the downloaded amount of data. When the download is finished, the occurrences are displayed on the map.

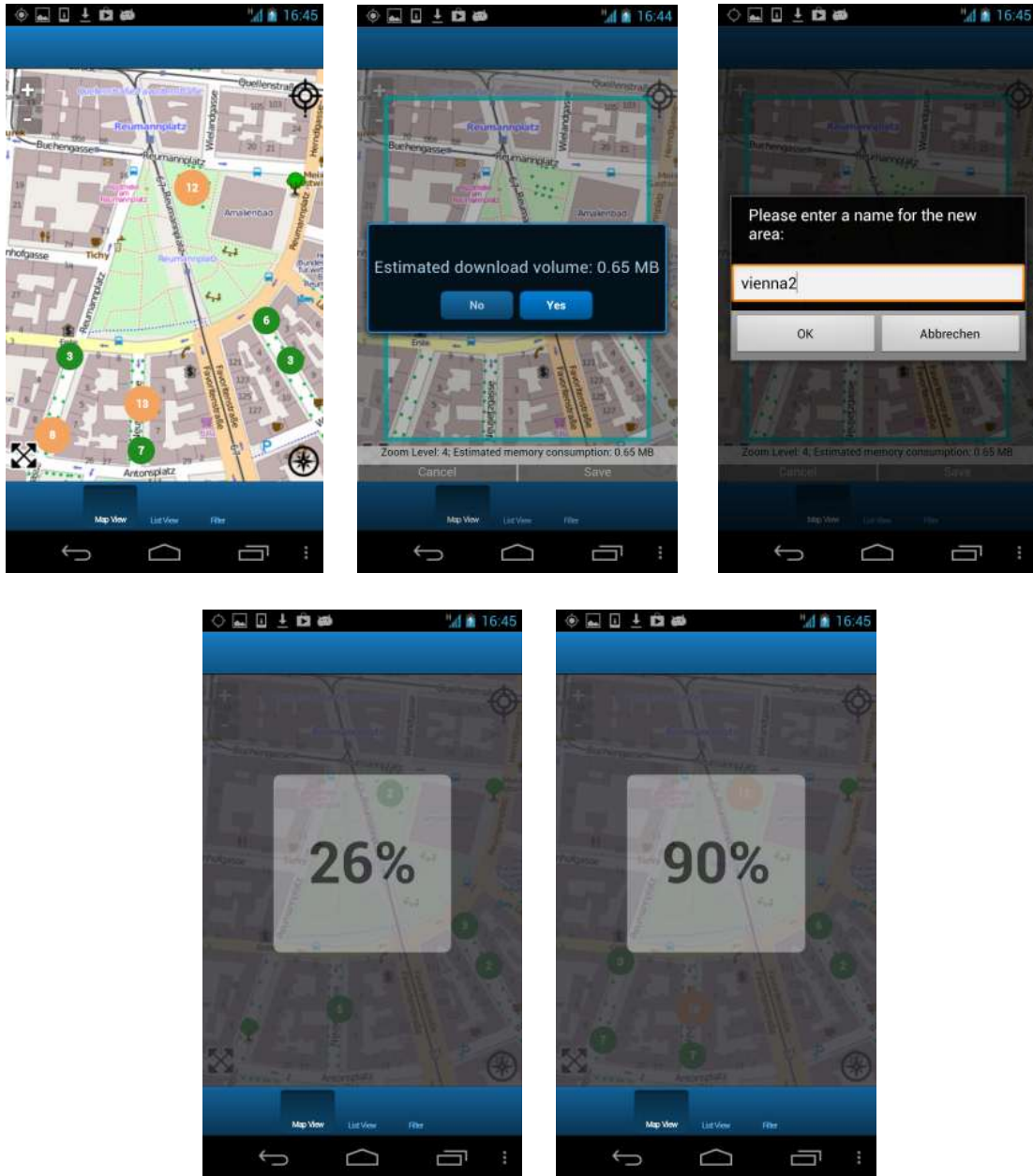


Figure 8: Define new Area of Interest

3.3.4.3 Switch between map view and list view

As explained in chapter 3.3.4.2 the occurrences contained in the areas of your interest are displayed as icons on the map. If you switch from map to list view, you will get a list containing all occurrences indicated by the identifier entered by the user who created the occurrence object.

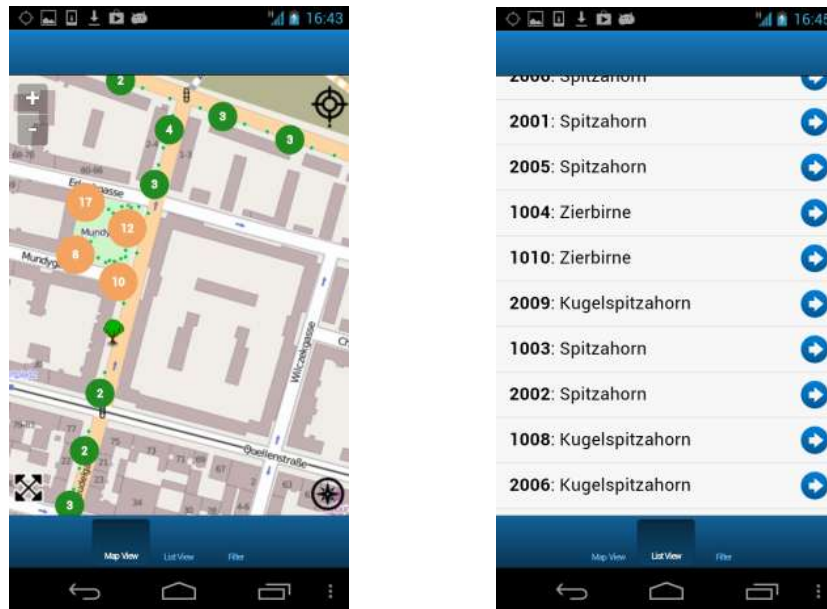


Figure 9: Map and List views

3.3.4.4 Display occurrence details

To display all data entered for one occurrence object you can choose

- In list view: tap on an item in the list
- In map view: tap on an occurrence icon on the map
- In “List Observations” screen: bring phone close to an NFC tag which was previously written by the application’s create NFC tag functionality (see chapter 3.3.4.7).

A List of observation objects will occur on the screen. The first entry contains the data and properties entered when the occurrence object was created. All observations entered by any users and assigned to this occurrence object are listed below. The provider name and the time when the observation was stored are displayed together with the properties and values of the observation.

For image observations, there are small pictures (thumbnails) displayed. Tapping on such a picture causes that the real image in its full size and resolution is displayed on the screen. Since the full images are stored on the cloud and downloaded only on demand, you will be informed that you are going to download a large data entity from the server and you can decide if you actually want the image to be downloaded. When an image is downloaded, it is cached on the device’s file system so that it does not have to be downloaded again when it shall be displayed again. Currently, there will be up to twenty images stored in the application’s image cache.

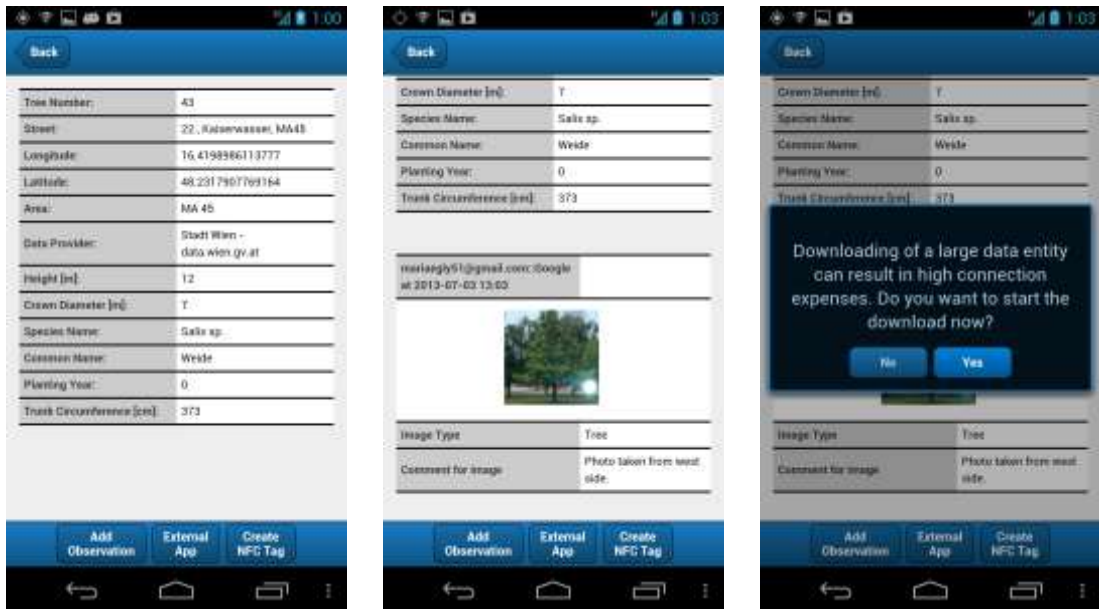


Figure 10: Details view

3.3.4.5 Enter new observation for existing occurrence

In the occurrence details view (see 3.3.4.4) you have the possibility to add a new observation to an existing occurrence object. Tapping on this button will bring you to a screen where you can select one or more properties for which you want to enter values. To keep the list of properties displayed on the screen manageable, the items can be hidden when tapping on an item in the selection list which is currently displayed. The values entered for hidden items are not deleted but will be overtaken into the observation object when it is stored.

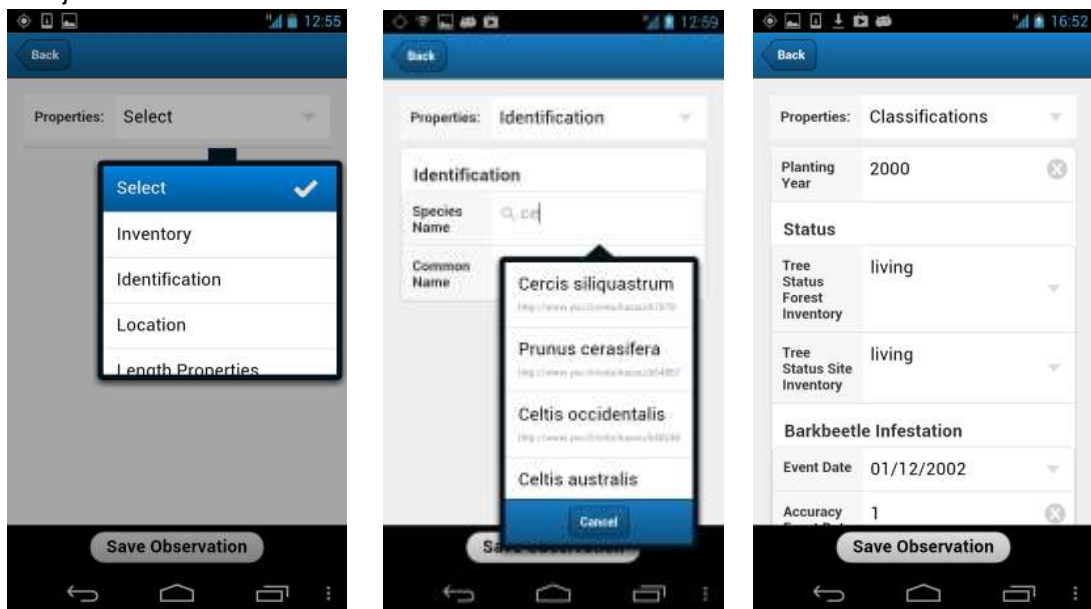


Figure 11: New observation (1)

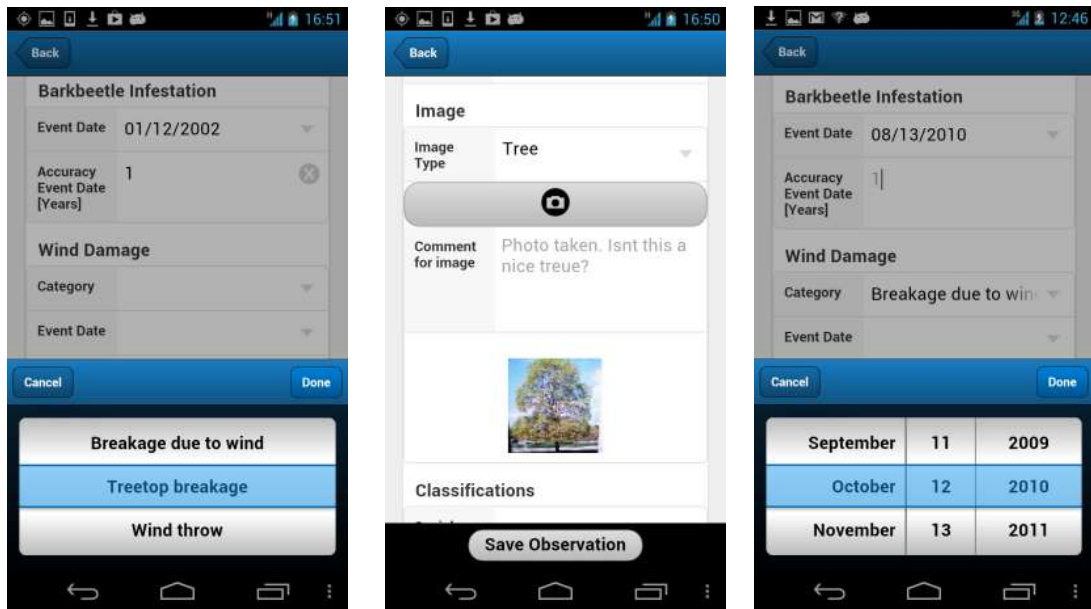


Figure 12: New observation (2)

The Properties are grouped into following items:

- Inventory
An identifier which you can use for assigning a name by which you occurrence will be known by the community using the application
- Identification
Here you can select from a list of scientific or common species names, which are retrieved from the TaxMeOn species ontology. The user can type one or more characters and press “done”. A list of species names containing the previously entered character sequence, and their ontology URIs is opened. The desired name can be selected and the common name resp. species name related to the selected name is displayed in the appropriate input field. In the observation object the scientific and common species name as well as the ontology URI are stored and transferred to the observation collection service.
- Location
Provides the possibility to enter your observation about the geolocation of the occurrence in WGS84 coordinates as well as in geodetic coordinates consisting of azimuth, distance, and reference point
- Length properties
Height, crowning height, deadwood height, crown diameter, trunk circumference, and diameter at breast height can be entered as length properties
- Planting year
- Comment
An arbitrary text
- Image
Enter image type and a comment for the image; take a picture using the device’s camera
- Classifications (i.e. the social position of a tree)
- Status
Various statements about the status of the occurrence; in this application the tree status (tree health status, bark beetle infestation, wind damage, tree damages)

When values for the observed properties are entered, the observation has to be stored by tapping the button “Save Observation”. The screen switches back to the occurrences details window and the new observation is shown in the list.

When an observation is saved, the following process is executed in the background:

- A reference to the occurrence object is automatically added to the observation object
- The observation object is stored locally on the phone user’s database instance
- When the device is online resp. as soon as an Internet connection is available, the object is replicated to the database on the server which is dedicated to this particular user.
- If “Publish Observations” in the application settings is set to false, the object remains in these two databases. If “Publish Observations” is set to true, the new object is replicated from the user’s database on the server to the central database on the server. From there, it can be replicated to other users’ databases and from these to the users’ devices.
- Image objects are not persisted in the observations database but stored separately on the FI-Ware Object Storage GE and additionally in a separate database instance on the ENVIROFI observation collection server. The name of the image object is stored in the observation object. When the image shall be retrieved, this name is used to compose a URL for retrieving it via RESTful http interface either from the cloud storage or from the server’s image database. Additionally there is the thumbnail image stored as base64 encoded ascii string in the observation object, which is used to display the image observation in the occurrence details view on the mobile app. Tapping on an image thumbnail will result in displaying the real image as described in 3.3.4.4.
- When an image object of type “Leaf” is stored with an observation, the ENVIROFI specific enabler “Environmental image sample classification service” is triggered to take the image and classify it. The classification result is a probability value for the species identified from the leaf image. If the server receives the image classification result, an additional observation object is created for the occurrence. This observation object contains the leaf image classification result and the specific enabler service as provider of this information. As soon as this object is created, it will appear in the list of observation of the corresponding tree occurrence object.

3.3.4.6 Open External Application

When the button “External App” is clicked, the application builds an URL containing the geolocation coordinates of the currently displayed tree occurrence and sends it to each application which is installed on the mobile phone and is able to deal with this geolocation information. On most Android phones this will be the Internet browser or the Google Maps application. The user can select one of these external applications and the position of the occurrence is used to be processed by this app. E.g. Google Maps can be used to navigate from the current position of the mobile phone user to the position of the tree occurrence.

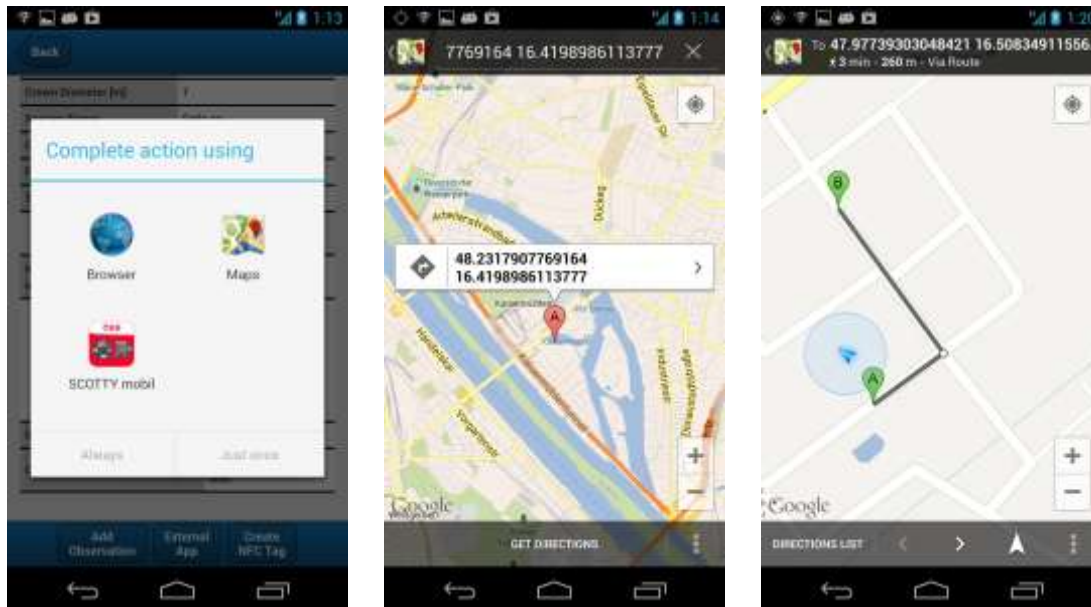


Figure 13: Open external app

3.3.4.7 Create NFC Tag

When tapping on button “Create NFC tag” a screen is displayed indicating that you should bring your phone close to an NFC tag. If you do so, a unique identifier of the occurrence object, which observations are currently displayed, is written to the tag. This way, you can e.g. create a label which can be fixed on a tree. When any other application user comes to this tree, (s)he can read the tag and will get the tree details immediately shown on the phone (see also chapter 3.3.4.4).

3.3.4.8 Enter new occurrence

A new occurrence object can be entered by tapping on the button in the upper right corner of the map view. A crosshair icon appears on the map, and the user can pan or zoom the map so that the location of the new occurrence is beyond the center of this crosshair icon. Tapping on the icon brings a screen into the foreground where the user can specify the properties of the new occurrence object (s)he wants to create. The minimum is to enter a tree number which does not have to be unique but can be used by the users to identify one occurrence amongst others e.g. when they are located in the same area. All other properties can be entered in the same way as when entering a new observation for an existing occurrence (see 3.3.4.5).

When all necessary properties are specified, “Upload Tree” will store the new occurrence in the local database triggering the following process in the background:

- When the device is online resp. as soon as an Internet connection is available, the object is replicated to the database on the server which is dedicated to this particular user.
- If “Publish Observations” in the application settings is set to false, the object remains in these two databases. If “Publish Observations” is set to true, the new object is replicated from the user’s database on the server to the central database on the server. From there, it can be replicated to other users’ databases and from these to the users’ devices.
- Image objects are handled the same way as described in chapter 3.3.4.5.



Figure 14: New tree

3.3.4.9 Filter

The occurrences displayed in map or list view can be filtered using the “Filter” screen. The user can choose between numerical or textual filters. For each of them, a list of appropriate properties is provided. For example, if you choose numerical filter and the height property, you can select a criterion (in case of numerical filters “equal”, “less”, or “greater”) and enter a number which is used to filter the trees displayed in list or map view when the user confirms the filtering by tapping on “Apply Filter”. “Remove Filter” will reset the filter so that all occurrences will be shown again.

This feature is currently implemented in a very simple way and has to be improved in the future. E.g. the field “tree number” is not necessarily a numeric value and should not be used for filtering.

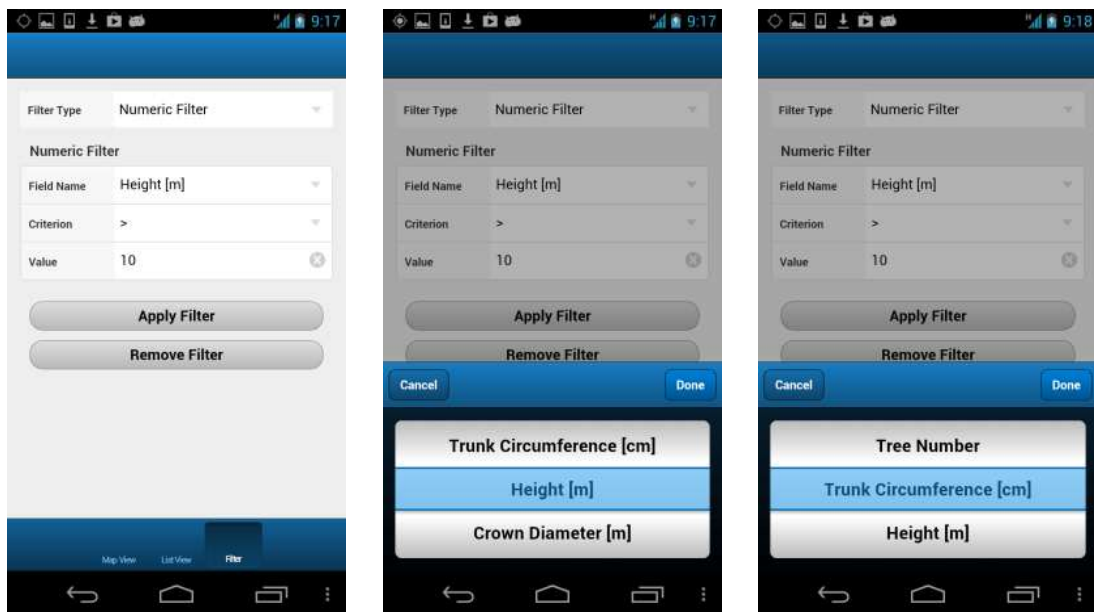


Figure 15: Filter (1)

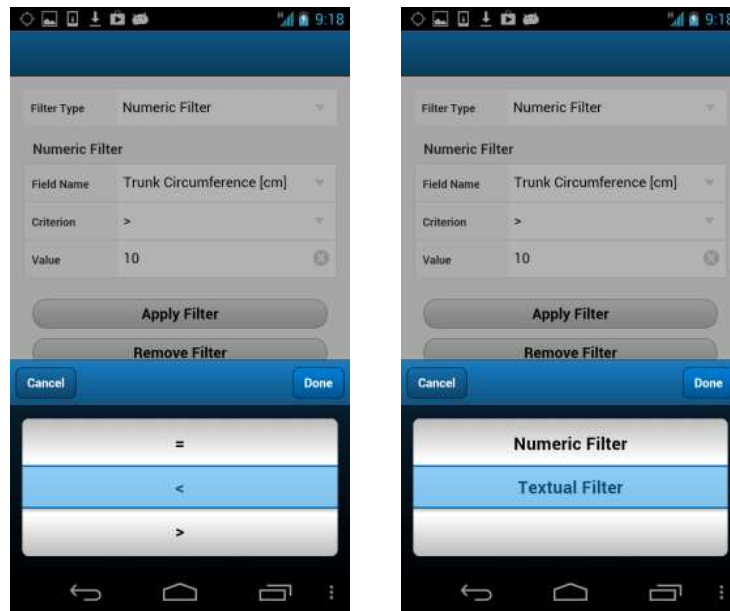


Figure 16: Filter (2)

3.3.5 Areas of Interest (Aol)

The definition of areas of interest is the base for getting any observations entered by any users of the application displayed on the map or in the list view. In chapter 3.3.4.2 there is a description of the graphical user interface how to specify an area of interest. This chapter describes how the Aols defined by a user can be managed within the application.

The button “Areas of Interest” in the main menu opens the list of all areas of interest defined by the current user. The list contains the names of the areas and the quantity of objects in each individual area. Areas, for which unread events are available, are displayed in red color, so that the user can recognize that new observations or occurrences were reported in this area.

When tapping on an entry in the list of Aol, the details of this Aol will be shown. This screen contains

- The name of the Aol
- The number of objects currently available in this Aol
- A button to switch live update of the Aol on and off. If switched off, new occurrences and observations entered by other users and located in this area will not be downloaded automatically to the mobile phone but only when “Refresh Objects in Area” is selected resp. when the live update is switched on again.
- A button “Show” to jump to the map view of this Aol
- A button “Refresh Objects in Area” causing to download all objects available for this Aol again from the server
- A button “Refresh Map” for reloading the map tiles from the map server, which are necessary to display this Aol on the map. Map tiles are downloaded from the server and cached in the device’s file system.
- A button “Delete Cached Map” to delete the map tiles cached for this Aol
- A panel containing a list of events related to this Aol, which can be filtered (to have all events in the list resp. to show only new events) and sorted by time when the event was created, by distance to the current location of the mobile phone, and by event status (i.e. if an event was already opened by the user or not)

Tapping on an entry of the event list causes that the details view of the tree occurrence related

to this event is opened, so that the user can read the observation information and report a new observation to confirm or amend this observation.

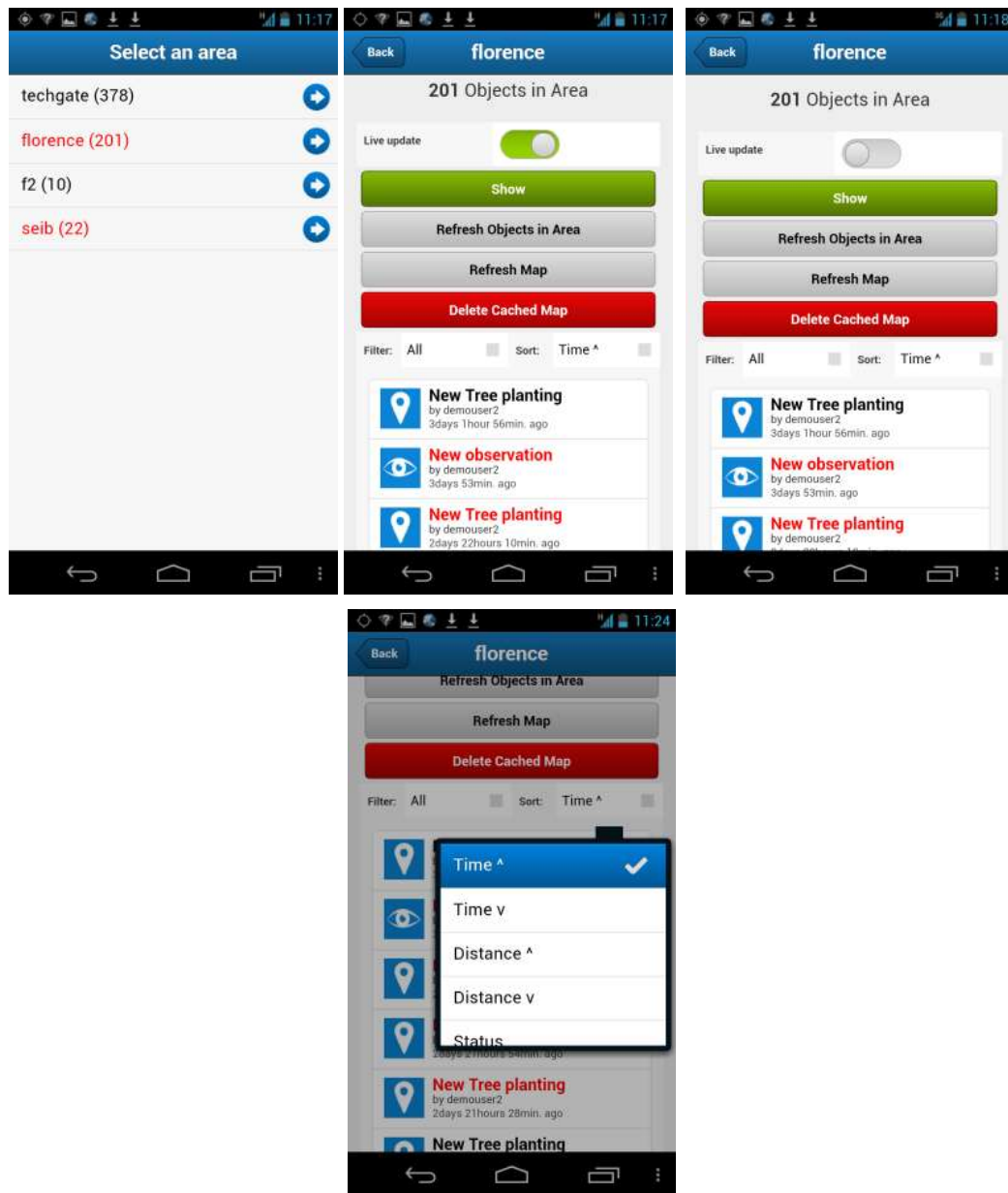


Figure 17: Areas of Interest

4 Feedback page

The feedback form is designed to capture responses from users and stakeholders with regards to the app's functionality, usability and usefulness. It also enables the user to provide input on suggestions for improvements as well as additional features. This data will be captured during the development and testing phases of the project with the results making up part of the final deliverable documentation. This data can then be used to improve the system in any future phases. This form will be available online from the ENVIROFI Products page.

Feedback Form for ENVIROFI-BIO

Installation

How would you rate the installation process for the App?

Very Good	Good	Bad	Very Bad
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Basic Usability

How user friendly is the App?

Very Good	Good	Bad	Very Bad
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How would you rate the configurability of the App?

Very Good	Good	Bad	Very Bad
-----------	------	-----	----------

How easy was it for you to find data of interest in your area?

Very Easy	Easy	Bad	Very Bad
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Providing Observations

How important is it for you to provide your own observations to the App?

Very Important	Somewhat Im- portant	Not very im- portant	Not Important at all
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How easy was it for you to provide your observations using the app?

Very easy	Easy	Difficult	Very Difficult
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Your experience with the prototype

How long have you been using the ENVIROFI-BIO App prototype?

sporadically (less than one day per month)	regularly (at least one day per month)	a lot (more than one day per month)
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Which features would you improve?

Free text 400 words

Additional Comments

Free text 400 words

Would you be interested in participating in other tests related to ENVIROFI?

E-mail for future contacts (with due privacy statement)

Please note that as our main test area is located in Tuscany, Italy, the feedback form is available in Italian.

5 Suggestions

Bug reports and suggestions shall be placed at: https://service.ait.ac.at/mantis/main_page.php

6 Conclusions

The ENVIROFI-BIO mobile phone application is a working prototype that is under continual development using an agile development process. At the current development stage, end May 2013, we have made significant progress in the provision of biodiversity occurrence data based on the user's location as well as allowing the user to provide further information and observations to the system.

Within the first version of this document ([01]) we explained why we have been focusing on trees for the biodiversity pilot application. In order to put more effort on improving the stability of the application and its reliability when using it offline, we decided to defer the dynamic provision of properties and to stay on trees as prototypical observation objects. Application tests during the winter in the remote area of the LTER (Long Term Ecological Research) site with no mobile network coverage and a high density of trees showed that these are important preconditions to use the application for the acquisition of biodiversity observations.

All other functionalities mentioned as future extensions of the application in [01] have been implemented – at least in a proof-of-concept stage - during this last ENVIROFI project phase. The dynamic selection of observed properties from a list is available. The species identification is based on the TaxMeOn species ontology, the user can select from a given list of common and scientific species names. For further improvements, the URI to the TaxMeOn ontology is stored with the species information in the observation database. The base for a future implementation of functionality for querying and using further contents of the taxonomy is established. The introduction of events is the basis for observation quality assurance mechanisms based on crowdsourcing and community collaboration. Via events, users can be asked to confirm or decline observations of other users, or to correct the information reported by other community members. And last but not least, the image classification service has been integrated in order to provide automatic recognition of tree species based on images of the leaves of the trees.

Due to the various constraints within the ENVIROFI project it was only possible to provide a fairly simple prototype for biodiversity survey, tailored to suit the needs of both nature hobbyists as well as professionals. However, through the definition of modular Specific Enablers, the basic building blocks required for the creation of a wide range of applications have been implemented. On this basis, other types of biodiversity applications could be implemented with minor modifications to the already existing ENVIROFI-BIO app.

7 References

References	
[01]	ENVIROFI Consortium, 2012. "D1.4.1 Pilot applications for Biodiversity Scenarios I - Guidelines document "

Table 2. References