

Quality Improvement of the Cadastral Index Map

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Key words: cadastral map, positional accuracy, crowdsourcing, smartphone

SUMMARY

Finnish cadastral index map contains about 11 million boundary markers. Of these, about 2 million are located in city areas and the other 9 million in rural areas and on forest land where the Cadastre is kept by the National Land Survey of Finland (NLS). There is no accurate information on the existence of the boundary markers in rural areas and forests but approx. 10-20% of those are estimated to be missing.

Approx. 70% of boundary markers in rural areas and on forested land have coordinates with a positional accuracy of 1.0 meter or better. The positional accuracy indicates a 67% probability of the positional accuracy of the boundary marker. The positional accuracy of the remaining approx. 3 million boundary markers varies between approx. 1 and 10 meter.

NLS has launched a project to improve the reliability of the boundaries of the cadastral index map. There is no quick and cost-efficient solution for improving the accuracy of the 3 million boundary markers.

The problem with all effective remote sensing methods is that the boundary markers must be made visible in the terrain, meaning that it makes more sense to measure it directly. The solution could be crowdsourcing. It is likely that smartphones will be able to reach a better than 1 meter positional accuracy within a few years. In this case, the smartphone could be used to determine or verify the location of the property boundaries. Property owners and forestry professionals could be encouraged to check the location of their property boundaries using a smartphone.

“Find a boundary marker in the forest” a smartphone game application helps find and identify boundary markers. When boundary marker is identified, the user sets up his or her smart phone on the boundary marker, takes a picture and measures coordinates simultaneously. Then the application sends all information automatically to the NLS where the information is verified and the cadastral index map updated.

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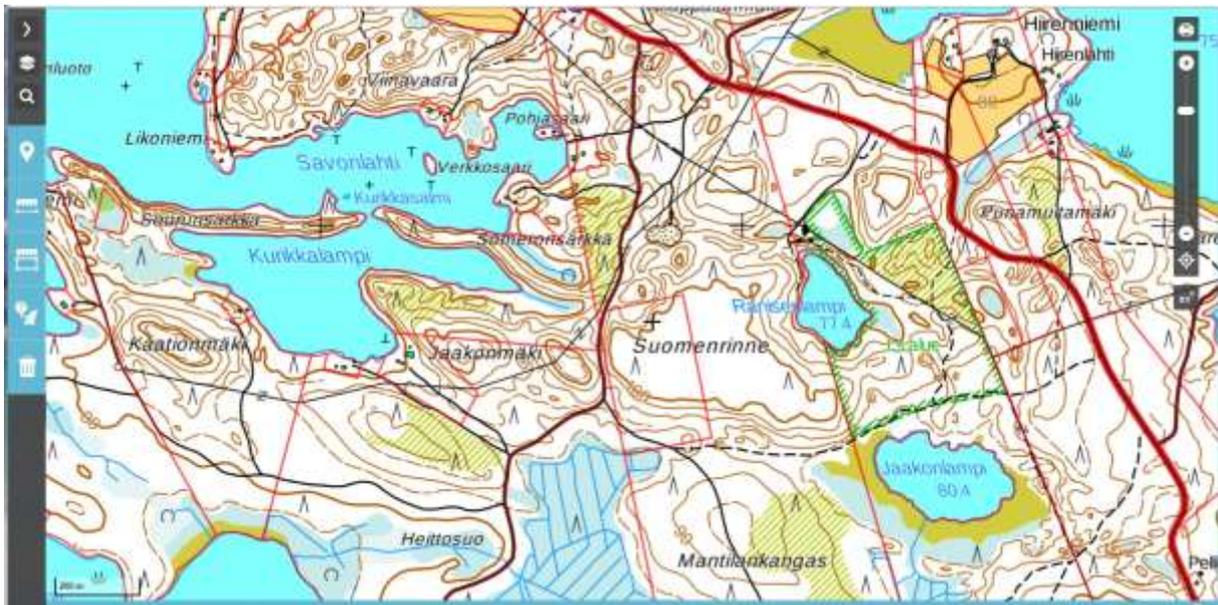
1. INFORMATION THE CADASTRAL INDEX MAP OF FINLAND

There are approximately 11 million boundary markers on the Cadastral index map of Finland. Approximately 9 million of these are located outside cities and have been set up permanently in the terrain. About 10 to 20 per cent of the boundary markers in the terrain have disappeared. Boundary markers have been destroyed when roads have been built, forests cut down and fields cleared. The oldest boundary markers are more than 300 years old.

The Cadastral index map of Finland is a good brand. Even if we tell users of the weaknesses of the positional accuracy of boundaries on the Cadastral index map, the users still trust the boundaries drawn on the map and find them correct.

Cadastral index map information about boundaries and property identifiers is used in other applications as well. The most popular of these is the MapSite, The application is available to all and it's free. Millions of map searches are performed using the software every year.

<https://asiointi.maanmittauslaitos.fi/karttapaikka/?lang=en/>.



2. ABOUT THE POSITIONAL ACCURACY OF BOUNDARY MARKERS

In general, the positional accuracy of the boundary markers on the Cadastral index map is good. The positional accuracy of 75 per cent, that is approximately 6 million, boundary markers in sparsely populated areas is one meter or better.

A positional accuracy of less than one metre has been achieved by measuring the coordinates of signaled boundary markers visible on aerial photos or by measuring with a GPS receiver in the terrain.

The positional accuracy of approximately three million boundary markers is one to ten metres. When a boundary marker has no exact coordinates, the location of the boundary marker has been roughly decided

The quality of the Cadastral index map is uneven in sparsely populated areas. Boundary markers with a poor positional accuracy have caused problems.

People have felled trees on their neighbours' land. Property transactions have taken place concerning areas that have not belonged to the seller. Power cables have been dug down and roads have been built on the wrong properties.

3. HOW COULD THE POSITIONAL ACCURACY OF THE CADASTRAL BOUNDARY MAP BE IMPROVED THEN?

It is time-consuming and costly to measure boundary markers by GPS. The solution is crowdsourcing.

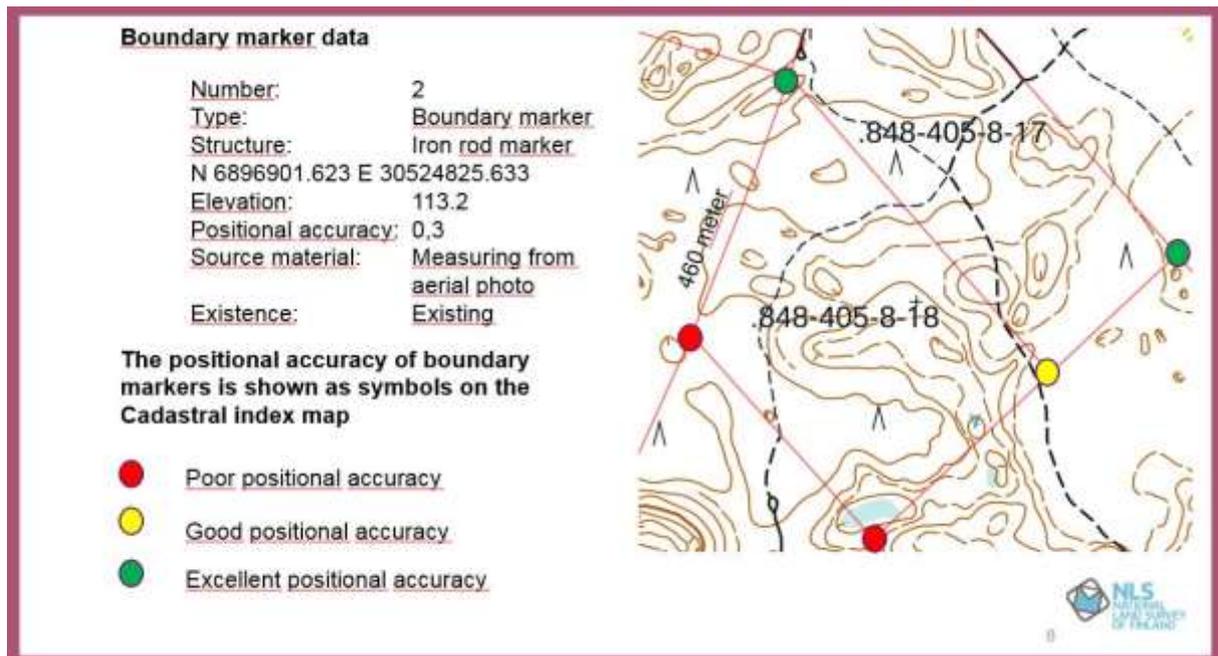
A smartphone app is developed for checking and measuring the positional accuracy of boundary markers. The app would use the web application of the Cadastral index map.

The app would be available to all and at no cost. In about three to five years, a positional accuracy of approximately half a meter can be achieved with smartphones. This is good enough for determining the boundaries of forest properties. The app can contain incentives for searching and measuring boundary markers.

With the help of a smartphone app, the user can be directed to the desired boundary marker. Information about the boundary marker can be given in words and pictures. For instance, what kind of boundary marker should be found in the terrain, and what should its number be?

For searching and identifying boundary markers, it would be good if the user could get the survey map on the smartphone. The survey map describes the boundary marker when it was set up.

To illustrate the positional accuracy of boundary markers, it could be shown in different colours on the Cadastral index map.



4. A PLANNED PROCESS

With the help of a smartphone and an app on it, the user can check whether the coordinates of the boundary marker correspond to the coordinates on the Cadastral index map or not.

If the coordinates are correct, the app tells it to the user. If the coordinates are wrong, the app instructs the user to measure the coordinates. The app tells the user (by voice) how to place the smartphone above the boundary marker. When the smartphone receives a sufficient positional accuracy, it asks the user to press the measuring button. When the measuring button is pressed, a photo and the coordinates are recorded at the same time. Furthermore, a sloping photo is taken, which shows the number of the boundary marker.

The data is sent automatically to the controller at the National Land Survey. On the basis of old cadastral survey documents, aerial photos and other material, the controller at the National Land Survey evaluates whether the location of the boundary marker can be corrected to the reported coordinates or not. If it can, the controller corrects the location of the boundary to the reported location.

Feedback about the correction or that the boundary could not be corrected is sent to the producer of the data.

A planned process

- Checking and measuring the location of the boundary marker
- Instructions on how to measure, sufficient positional accuracy, photo and coordinates at the same time
- Photo also of the number of the boundary marker
- Sending the data to the National Land Survey





5. BENEFITS

This method is very inexpensive. Members of the public collect the exact location data of the boundary markers for free. It remains for the controller to check that the data is correct and to correct the Cadastral index map.

This is a fast way to correct errors on the Cadastral index map.

The location of the boundary in the terrain and on the Cadastral index map are made to correspond to each other. The corrected data is immediately available for everyone.

The system encourages the use of map bases on smartphones. Your current location is shown on the map, which encourages you to spend time in forests without fear of getting lost.

Anyone can participate in the checking and measuring of property boundary location data. A suitable smartphone is all that is needed.

The forest is a mysterious place for many people, especially for people that have lived all their lives in a city. The system encourages people to visit the forest. For instance, if you have inherited a forest property.

The system can also be used for updating the data of other objects in the terrain. Data about new roads and new or demolished buildings is sent to the controller.

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Quality Improvement of the Cadastral Index Map (9902)
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FIG Working Week 2019
Geospatial information for a smarter life and environmental resilience
Hanoi, Vietnam, April 22–26, 2019