Precision farming also for small scale farmers

Walter H. Mayer (CEO)

PROGIS Software GmbH
Postgasse 6
9500 Villach
mayer@progis.com
office@progis.com

Abstract: The current and future food insecurity situation of many nations has been effected by factors like global warming, population growth, bio-energy, low technology acceptance, unfavourable policies, sustainability criteria, changing natural risk-management and subsidies. Food availability is a basic human need and, if left unattended undermines any other development effort. Sustainability-, agriculture-, forestry- and environmental targets are interlinked and influence each other. There are needed **new types of land management** covering protection of land and biodiversity, guaranteeing a sustainable management and a multipurpose land use, optimising the economical benefit and evaluating the land use potential with its carrying capacity. **ICT technologies** underplayed with **expert data, easy to use software–** and **precision farming technologies** will be essential to achieve a sustainable bettering – if no-one is suspended. Even small-farmers must have access to know-how, equipment and technologies to optimise the food production processes by taking into account nutritional and/or biomass targets and to secure a sustainable agricultural development. Training of land owners, new types of advisory services and a rise of public awareness must be accompanying measures.

FARM MAPS – GIS DATA:

The **First requirement** for precision farming (PF) is the setup of GIS data to have details about the location of the field or also the forest department. The data to gather are the field polygon that gives the size in hectare of the field and is the base for all later calculation. A failure of e.g. 5% in the length measurement of a field would show a failure of nearly 10% in the size of the field; and this failure has impact to all further actions - all following calculations would be 10% wrong. This shows the need of having exact field polygons as first requirement. As I do not assume that all small farmers will be running their own PF equipment as well as have the necessary ICT environment, the future will show us **PF service providers** for regions or even complete countries. The technology enables a farmer to send a contract to a service provider including a map that shows in detail where, what and when has to be done, e.g. PF – fertilisation based on a chlorophyll map or based on a soil investigation including the knowhow of the history of the field.

UNDERLAYING EXPERT DATA:

Integrative ICT technology like "**AGROffice"** which bases on the GIS-System **"WinGIS**" guarantees to plan with the embedded expert model what is the **next requirement**. It makes no sense that every farmer builds up his own database of seeds,

machines, fertilizers, pesticides, etc., everything linked to costs and information on nutrient content and chemical components. This has to be done by one team per country or region and can easily be distributed via Internet. Suddenly such a model allows that the farmers get permanent access to latest information of the science and of the day by day changing market requirements. A good expert database must be regularly and sustainable maintained and updated.
Further there are integrated predefined single steps of every production process per year resp. per crop rotation for all the single crops.

SERVICE PROVIDERS:

Beside farm management with intelligent tools other applications like for logistics, for forestry-, environment- and risk management can be used. Large farms will use these technologies by their own, small scaled farms will use it indirectly by farm advisors. The advantage for an advisor or groups of them is the aggregation of all farmers data. For example bundle fertilizer/seed needs or crop sales for better prices. He can define new geo-regions for working on watershed or environmental projects and use available data within a trust centre for later use. The increased use of PF supported agricultural machineries will help to optimize fertilizing and spraying to preserve soil conditions, to reduce CO_2 emissions, to save money etc. With mobile communication (UMTS/GPRS) and GPS (dGPS) technology (geo)-data, or PF partial-maps with a

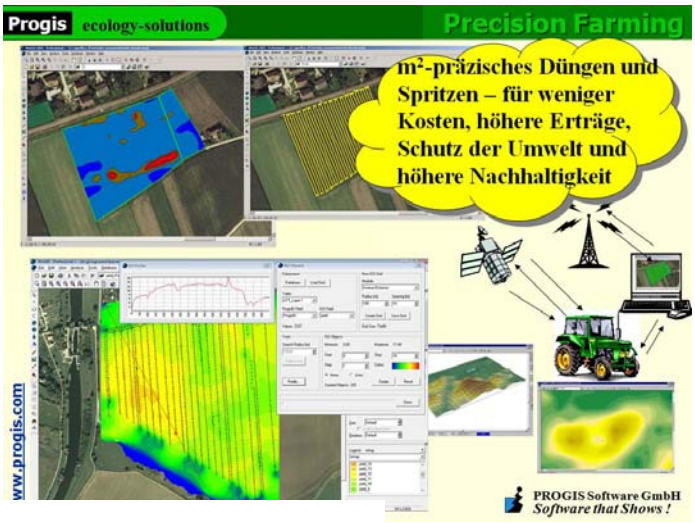

Abbildung 1: Precision farming

fertilizer- or sprayer contract can be sent to tractors. Hardware interprets the map and fulfils the contract. The feedback comes to a HQ incl. changes. That´s precision farming! Add harvest maps and you have m² precise calculation. A good system also can send route coordinates to tractors and the tractor drives, automatically, or sprays or fertilizes according to a given map.

LOGISTIC:

The next large step of advisory groups will be to organize **logistic**, that means the use of machines, their management, the guiding to fields, controlling their work and organise even just in time delivery to factories or protocol or bill their work. When the whole process of machine use is integrated, such systems get enormous values and allow return of invest rates of one or two years maximum. It is also of interest that several beneficiaries benefit from such a logistic system: farmers, buyers, food factories et.al.; this allows also cost sharing for the implementation of such models. To describe the logistic model that is installed at the German machine Cooperatives in large parts of Bavaria and Baden Württemberg, supporting 6 factories and ten-thousands of farmers, following steps are integrated:

- The Machine Cooperative prepares the different tasks on the fields during the year (also import of polygon data from an INVEKOS system) and then start to plan the detailed activities on the fields according the data, their know how, historical know how or such based on new contracts that the farmers send them from their farm management system.
- A GPRS based contract is sent to the machine – a ruggedized laptop on a machine – and the driver gets displayed on the screen on his installed orthoimage-map "where to do what" and starts to work on the first field to where he is also guided from the map.
- After finalizing the work on a field, with the press of one button he informs the central logistic system of what he has done and a protocol is stored at the drivers PC for later on accounting and the dispatcher´s screen is showing the updated map in new colours.
- In a case like the sugar beet harvesting, data of the location of the sugar beet lots and the amount of beets is also transferred to the central logistic system so that the dispatcher is enabled to send a next contract to the pickup machine: Where how many sugar beets have to be picked up and the pickup sends contracts including guidance to the integrated TOMTOM systems to one or several trucks as needed.
- With the upload of sugar beets on the trucks, the necessary data are transferred into an RFID system on the truck and the truck drives sugar-beets and data into the factory, unloads the freight and transfers automatically these data into the factories IT system when arriving at the factory door.

The dispatching station is necessarily enabled to bill these data and is also enabled not only to serve one crop but all crops. The future will show regional logistic providers where many users are linked – the regional agro logistic system supporting agriculture AND forestry.

VIRTUAL FARMING:

Link small fields together and spread the return on invest according m²-based results. It works for large single farms or for groups of small farmers. More options give the link to **sensors** for meteorology, helping to optimize water controlling and when to start or stop irrigation. Another system we introduced is **Virtual farming**, the tool for land consolidation handling cadastre data, soil maps, ownership information and tools for optimizing different farms. (Prof. Auenhammer called this method "Gewannebewirtschaftung"). Leave the fields as they are, organize out of many small

and bad shaped fields owned by several farmers, some larger virtual, optimized shaped ones, cultivate them, protocol and distribute costs and earnings per m² . You will reduce costs up to 30% and more.
Based on these concepts the Austrian Agrarbehörde installed 40 systems to do land consolidation. GIS and database are linked and all calculations including import of geodetic data can be done on the fly. We can now discuss if such **land consolidation** is part of PF but it also allow to be more precise. The owner stays owner on its fields but a group of farmers arranges to cooperate for a time of let´s say 10 years in that way that they make out of her many and bad shaped fields less optimized shaped fields. Naturally also environmental criteria should be taken into consideration. When driving with new machines we can protocol where we drove with which machine and also where we e.g. fertilized how many kilogram/ha and where we harvested how many tons per hectare. Based on all these data an intelligent IT system can automatically calculate the cost, revenues or the contribution margin of every square meter and naturally also of every field. Reduction of costs can be in the amount of again 30% or more.

MACHINE INTEGRATION:

Technology behind many PF concepts is well known technologiy like ISOBUS. For small farmers it becomes of interest only when powerful service providers organise an integrated approach that fulfils all the needs of small farmers who want to do PF on their fields. Such technologies need the integration of service providers that understand the needs to be done on fields, have themselves or have the link to service providers that have the machines to automatically interpret the data coming from the service providers and do a protocol of what has been done and based on this do billings.

ENVIRONMENTAL CARETAKING and GOVERNMENT SUPPORT:

As PF is supporting the farmers but parallel also the environment, at the end I just can recommend that in the future the governments should use the possibility that e.g. the new Renewable Directive gives them to let these farmers who install PF to more benefit from CO_2 reductions. This because PF also lowers CO_2 emissions. This would be an easy to be implemented model to allow supporting farmers for their environmental caretaking work and parallel push the use of technologies. If the government take the CO2 question seriously they have to support PF technologies.

SYSTEM INTEGRATION AND SERVICE PROVIDERS – A MUST FOR SMALL FARMERS:

Beside technology – this is today available – the key questions for the future is the integration of different technologies and the set up of the right structures to service these technologies. For small farmers these technologies are an enormous chance, but only when support from service providers is arranged. Although when today still some governmental or semi-governmental structures try to be involved in PF, I think that an exact work-plan that splits the work between private and public structures without involving politics but defining clear rules and support from the politic has a future and will support the needs and the chances of the necessary small farm structures.