Agrisoft Systems
NEWSLETTER
Thirty-sixth edition, Jan.— Mar. 2021

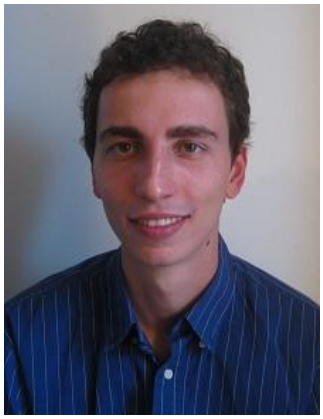
Message from the Management

Working towards OMP 10.1

Dear Customers and Friends,

On behalf of the Agrisoft Systems team I would like to wish you a happy Easter. Over the past three months, our main focus has been the ongoing work on the next planned OMP release, OMP 10.1. The new features that we have planned can be separated into two large categories. On the one hand, we are working on a new OMP-GIS program that will function as a standalone application completely independent of any GIS host program such as MapInfo or ArcGIS. The other large group of changes concerns the main OMP application and existing add-ins, with the largest individual change being the possibility of recording the area in yield for t/ha calculations explicitly on a monthly basis.

Due to the fact that we are re-coding the entire OMP-GIS application as a standalone program, we are having to spend a significant amount of time re-coding thematic mapping functionalities that already existed in previous versions of OMP-GIS. However, I am convinced that the standalone nature of the new version will be a huge advantage compared to previous versions. This is because with the previous versions, the costly licenses for the GIS host programs (MapInfo or ArcGIS) mean that in the majority of cases only one user in the company has a license and is able to use OMP-GIS. . The new program on the other hand will enable every OMP user including field managers and agronomy staff to run and use OMP-GIS for spatial data analysis. Besides this, the major new functionality that will be included is the possibility to display point maps of OMP Field Survey data. This is particularly useful to provide maps to workers or managers that pinpoint particular points or palms where some kind of action is required, for example in the context of pest and disease control.



Besides the development work, we are pleased to say that three new OMP installations have been carried out at plantations in Mexico, Brazil and Nigeria. With the coronavirus situation in many countries unfortunately still far from good, it was clear that all installation user training courses would have to be held as remote trainings. By now, we have been able to complete a number of new OMP implementations in a completely remote manner. Even in non-Corona times, this is of course far cheaper and more time-efficient than a classical on-site training visit.

One very interesting feature in the OMP Fertilizer Planner application is that it is possible to easily take into account nutrients supplied in the form of mill residues when creating recommendations for mineral fertilizers. By reducing the amount of mineral fertilizer that needs to be applied, taking into account the nutrients of mill residues can lead to significant savings in the fertilizer bill. This newsletter contains an article discussing this process in detail, including real-life example data from one of our OMP users.

Yours sincerely,

Max Kerstan

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Use of OMP for preparing an integrated nutrient plan

Thomas Fairhurst[1], and Max Kerstan[2]

1. Introduction

Appropriate nutrient management and fertilizer inputs are essential for oil palm plantations to reach and sustain high yields. On the other hand, fertilizers are typically the single most costly input in oil palm plantations. Mill residues (empty bunches, decanter or tricanter cake, POME) contain significant amounts of nutrients. By applying mill residues in a systematic and extensive manner, it is possible to cover a portioin of the palms' nutrient requirements using the mill residue nutrients. This can provide a significant saving in costs for mineral fertilizers among other environmental benefits arising from the efficient recycling of mill residues.

In this paper we outline the use of OMP and OMPFP as tools to prepare an integrated nutrient management plan that also can be used to quantify the financial impact of using mill residues as substitute for mineral fertilizers.

2. Preparation steps

Applying insufficient nutrients over a sustained period of time will lead to nutrient deficiencies and reduced yields. Therefore plantations looking to reduce their mineral fertilizer application by substituting organic fertilizers or mill residues must commit to applying these residues in a systematic and scheduled manner, just as they would apply inorganic fertilizers. The first step towards this is a realistic budget for the expected availability of crop residues by month in the year for which fertilizer recommendations are being prepared. Secondly, knowledge of the nutrient content of the mill residues is needed in order to be able to calculate how much mineral fertilizer can be reduced. Finally, a plan must be formulated for how the available mill residues should be distributed to the blocks.

2.1. Estimation of the mill residue availability

The starting point for estimating mill residue availability is creating a monthly crop budget. In OMP, a crop budget can be prepared in the OMP -CB add-in by inputting estimates of the fruit bunch yield (t/ha) and crop distribution (% annual crop per month) for each block. OMP-CB then estimates the availability of mill residues based on the user's assumptions on extraction rates (mill residue as a percentage of fruit bunch production) and the crop budget.

Extraction rates for mill residues are given in the literature (Table 1) but should also be determined locally because extraction rates vary between mills and plantation sites. Especially for effluent the rate can vary significantly and it is recommended to use a flow meter on the effluent outflow to measure the quantities as accurately as possible.

Table 1. *Extraction rates for mill residues.*

Mill residue	% fruit bunches
Empty fruit bunches	18–22
Decanter cake	3-4
Tricanter cake	8–10
POME	70

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Standard application rates (t/ha) can be entered in OMP-CB for each type of mill residue. This has the purpose of calculating the area that we can expect to be able to cover with the available mill residues in each month (ha/month).

Actual application rates for mill residues may, of course, be different from the OMP-CB estimate on a block by block basis, but the purpose here is to make a rough estimate of the number of blocks in which crop residues can and should be applied in each month.

At this stage, OMP-CB produces a report that shows total mill residue production, based on the crop budget (t/ha), crop distribution (%/month), and mill residue extraction rates.

2.2. Estimation of the nutrient content of mill residues

In order to calculate possible savings of mineral fertilizer, it is essential to determine the nutrient content of all the mill residues used. Standard values for mill residue nutrient content can be obtained from the literature (Table 2) but should be cross checked by local testing and a verified laboratory.

Table 2. *Nutrient content of mill residues.*

Mill residue	N	P_2O_5	K_2O	MgO
	% fresh weight			
Empty fruit bunches	0.3	0.1	1.2	0.1
Decanter cake	0.5	0.2	0.7	0.3
Tricanter cake	0.5	0.2	0.7	0.3
Compost	0.6	0.2	1.1	0.3

Most data provided in the literature is given on a dry matter basis and must therefore be adjusted for moisture content because mill residues are applied in the field 'fresh from the mill'.

The nutrient content of empty bunches is reduced by so-called 'double pressing' fruit bunches in the mill.

Some companies prepare compost from mill residues and its nutrient content should also be determined.

2.3. Deciding on goals for mill residue use

Once the overall availability of mill residues has been estimated, the user must decide how these residues should be distributed to the individual blocks. There are different factors to consider to determine the overall application strategy.

Besides their fertilizing properties due to the nutrient content, mill residues can help improve soil properties and increase organic matter content. Where mill residues are used to ameliorate poor soils, the application rates may be large. For example, an application of 60 t/ha empty fruit bunches or 40 t/ha decanter cake may be appropriate on sandy soils where the goal is to improve soil organic matter content.

On the other hand, application of mill residues can be challenging due to the large application rates involved. Therefore it may be advantageous to prioritize blocks with favorable application conditions (e.g. flat terrain, close to mill).

Low palm nutrient status should only be a secondary factor when choosing blocks for mill residue application, at least when aiming to use mill residues as a substitute for mineral fertilizer. This is because in any case mineral fertilizers will be used to 'top up' the nutrient application up to the nutrient targets for each block. As mineral fertilizers can be applied more easily and their availability in a given month is easier to guarantee, they may be are a more reliable source of

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nutrients for blocks with nutrient deficiencies. Only if a plantation decides to ignore the nutrients from mill residues and aims to always apply the full dose of mineral fertilizer regardless of the mill residues applied does it make sense to prioritize blocks with low nutrient status for mill residue application. In this case the mill residues in effect provide 'bonus' nutrients on top of the normal fertilization target.

2.4. Preparing a plan for mill residue use

The OMP-CB output provides an indication of mill residue availability and the rough hectarage that we can expect to supply each month at standard application rates. This information is then used as the basis for preparing a detailed mill residue application plan by block and month, following general application strategy considerations as outlined above. The filter tool in OMP can be used to select blocks using combinations of different parameters (e.g. division, soil type, topography, palm age or year of planting (YOP)) to identify a sub-set of blocks for mill residue application. The precise filter criteria that are useful depend on the overall mill residue application strategy. Blocks where POME is applied each year can be tagged using the Nutrient Marker so that they can be selected easily when preparing the nutrient plan. GIS maps may help in visualizing factors such as distance to the mill or to major roads or rivers.

On the basis of this information, the user enters the application rate (t/ha) by month for each block. The user makes continuous checks to verify that mill residue availability projected by OMP -CB is sufficient for the total planned mill residue application in any given month.

3. Using mill residues as a substitute for mineral fertilizers

3.1. Mill residues in OMP Fertilizer Planner

When using the OMP Fertilizer Planner (OMP-FP) for preparing recommendations of mineral fertilizers, it is straightforward to take into account mill residues as an alternative source of nutrients.

OMP-FP follows a two-step approach to fertilizer recommendations. The first step is to determine the 'nutrient targets', that is the amount of nutrients that we should aim to apply to a given block. The nutrient targets are calculated by evaluating rules against the OMP data for every block. The rules themselves are completely user-defined and can use a wide range of data including leaf, rachis and soil nutrients, soil type and texture, production data, field upkeep data and much more. In the second step, OMP-FP uses a powerful optimization routine to determine the optimal combination of mineral fertilizers to reach the block-by-block nutrient targets calculated in step one. The optimization is carried out using the nutrient contents and fertilizer costs entered by the user. The OMP-FP optimization routine covers only mineral fertilizers and not mill residues. However, the program includes the option of taking into account the nutrients supplied by mill residues, in order to adjust the effective nutrient targets for mineral fertilizers in each block prior to the optimization routine. For this purpose, the mill residue application plan by block and month can be imported into the OMP-FP scenario. Application and transport costs per ton for crop residue application can be entered, to allow the program to accurately calculate total cost of the fertilization programme including both organic and inorganic fertilizers.

All OMP-FP settings, including the crop residue application plan and associated costs, are entered by scenario. It is straightforward to set up

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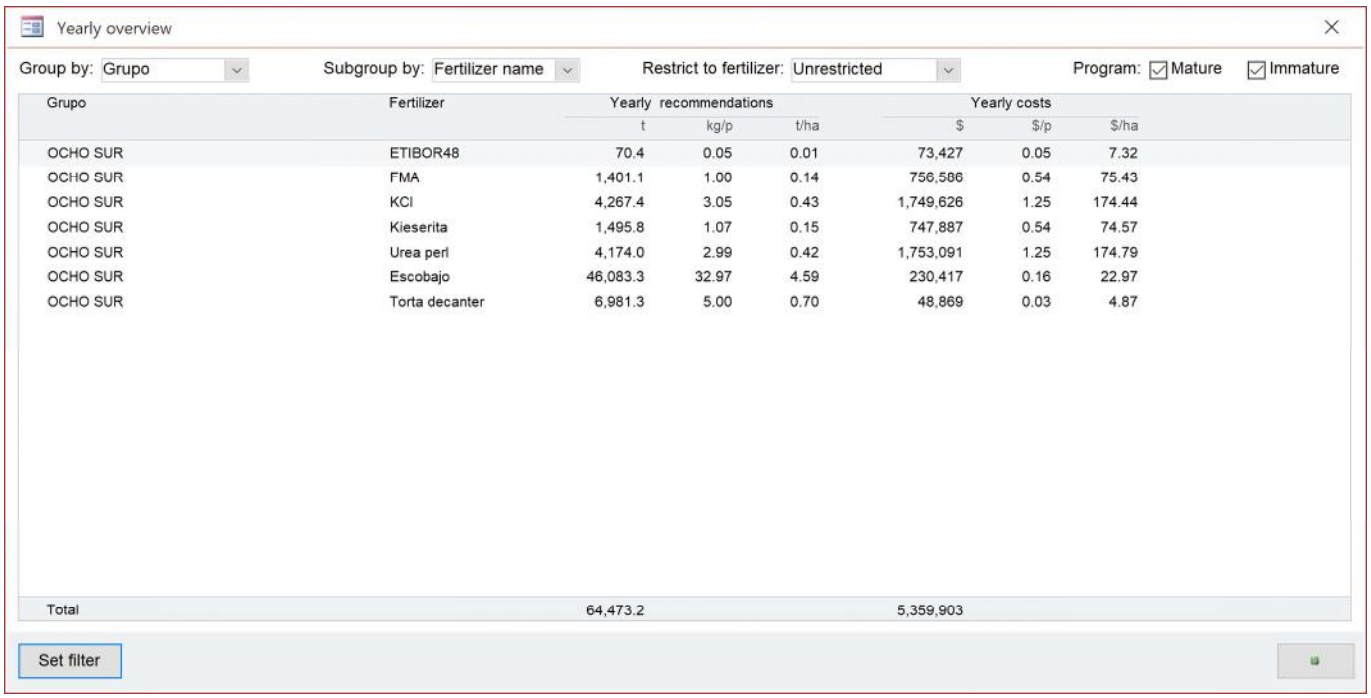
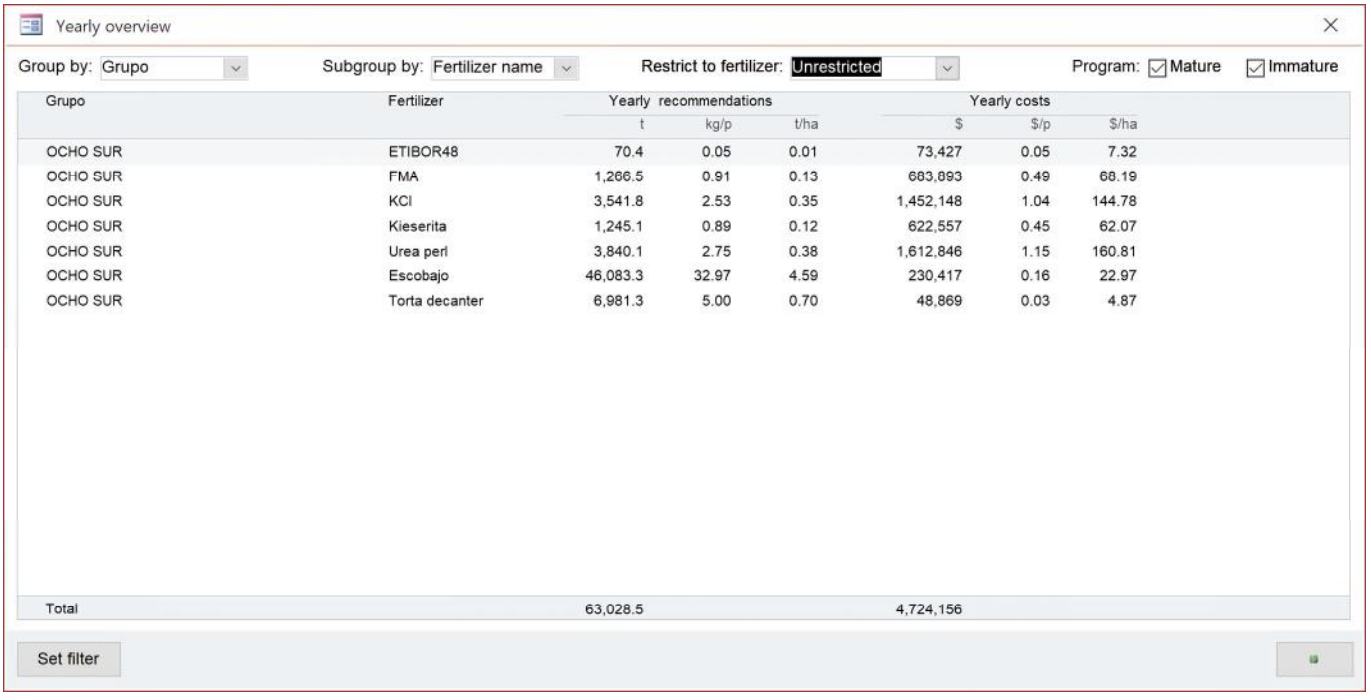


Grupo	Fertilizer	Yearly recommendations t	kg/p	t/ha	Yearly costs $	$/p	$/ha
OCHO SUR	ETIBOR48	70.4	0.05	0.01	73,427	0.05	7.32
OCHO SUR	FMA	1,401.1	1.00	0.14	756,586	0.54	75.43
OCHO SUR	KCl	4,267.4	3.05	0.43	1,749,626	1.25	174.44
OCHO SUR	Kieserita	1,495.8	1.07	0.15	747,887	0.54	74.57
OCHO SUR	Urea perl	4,174.0	2.99	0.42	1,753,091	1.25	174.79
OCHO SUR	Escobajo	46,083.3	32.97	4.59	230,417	0.16	22.97
OCHO SUR	Torta decanter	6,981.3	5.00	0.70	48,869	0.03	4.87
Total		64,473.2			5,359,903		

Figure 1. *Requirement and cost of mineral fertilizers and mill residues without nutrient substitution.*



Grupo	Fertilizer	Yearly recommendations t	kg/p	t/ha	Yearly costs $	$/p	$/ha
OCHO SUR	ETIBOR48	70.4	0.05	0.01	73,427	0.05	7.32
OCHO SUR	FMA	1,266.5	0.91	0.13	663,893	0.49	68.19
OCHO SUR	KCl	3,541.8	2.53	0.35	1,452,148	1.04	144.78
OCHO SUR	Kieserita	1,245.1	0.89	0.12	622,557	0.45	62.07
OCHO SUR	Urea perl	3,840.1	2.75	0.38	1,612,846	1.15	160.81
OCHO SUR	Escobajo	46,083.3	32.97	4.59	230,417	0.16	22.97
OCHO SUR	Torta decanter	6,981.3	5.00	0.70	48,869	0.03	4.87
Total		63,028.5			4,724,156		

Figure 2. *Requirement and cost of mineral fertilizers and mill residues with nutrient substitution.*

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and compare different scenarios to analyze how different assumptions regarding crop residue availability, nutrient content and application costs would affect the overall mineral fertilizer recommendations. As we will see in a concrete example below, taking into account mill residues can lead to significant savings in the overall fertilizer bill. This provides strong justification for putting in the effort to carry out the mill residue application in an accurate manner over as large an area as possible.

3.2. A real-life example

We illustrate this article with reference to Ocho Sur, a 10,000 ha estate in Pucallpa, Peru. All empty bunches and tricanter cake will be utilized in 2021. In our example, the cost saving of using mill residues as a substitute for mineral fertilizers is USD 64/ha with the quantity of mineral fertilizer required reduced from 11,409 to 9,964 t fertilizer materials, a reduction of 144 kg/ha or about 1 kg/palm without reducing the amount of nutrients supplied.

Note that in the example above, the same cost for application of the mill residues is included in both scenarios. In general this is realistic, because even when not planning to carry out nutrient substitution the residues produced by the mill must be applied somewhere. However, even if we were to completely ignore all costs from the mill residue application in the case without substitution, we still obtain an overall saving of USD 35/ha when practicing nutrient substitution.

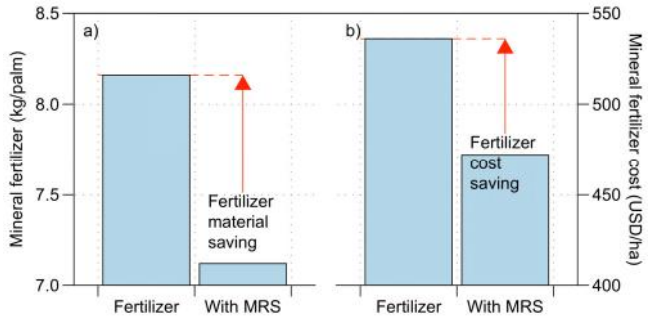

Figure 3. *In Ocho Sur, substituting nutrients supplied in mill residues for mineral fertilizers leads to a reduction of 1 kg/palm in fertilizer and cost savings of USD 64/ha*.

The substitution of mill residues for mineral fertilizer is illustrated in detail by the example of Block E04b in OSP_I Division, where it is planned to apply 30 t/ha empty bunches in 2021 (Table 3):

- Where the substitution rule is not invoked, the standard mineral fertilizer recommendation is not adjusted but large amounts of additional nutrients are supplied in the application of empty fruit bunches such that there is a considerable over supply of all nutrients, particularly of K2O.

- By contrast, when substitution rule is invoked, the amount of mineral fertilizer N and P2O5 are reduced to take account of nutrients supplied in empty fruit bunches (Table 3). No K2O and MgO is recommended because a sufficient amount of these two nutrients is supplied by the 30 t/ha application of empty bunches. By invoking the substitution rule, the amount of N, P2O5 and MgO supplied matches the standard fertilizer recommendation exactly. There is still over supply of K2O, but a smaller application of empty fruit bunches would reduce the substitution effect on the requirement for fertilizer N, P2O5 and MgO. The additional supply of K2O may lead to increased leaf and rachis K content and therefore lower K mineral fertilizer recommendations in the following year.

With nutrient substitution, the total cost of ferti-

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lizer and empty bunch application (materials and labour) in Block E04b is reduced from USD 514 to 445, a saving of USD 31/ha.

Scenario	Nutrient source	kg/palm			
		N	P_2O_5	K_2O	MgO
No substitution	Standard fertilizer	1.50	0.50	1.80	0.25
	Empty fruit bunches	0.89	0.30	3.55	0.30
	Total	2.39	0.80	5.35	0.55
Scenario	Nutrient source	kg/palm			
		N	P_2O_5	K_2O	MgO
With substitution	Reduced fertilizer	0.61	0.20	0.00	0.00
	Empty fruit bunches	0.89	0.30	3.55	0.30
	Total	1.50	0.50	3.55	0.30

Table 3. *Example of nutrients supplied with and without substitution from 30 t/ha empty fruit bunches.*

As with mineral fertilizer, it is essential to monitor the implementation of mill residue application recommendations. Once mill residues have been entered in OMP, it is possible to monitor implementation at company, division, field and block level each month. The goal is to instil the same discipline to mill residue utilization as is applied to fertilizer application.

4. Conclusions

OMP provides the means to estimate the production of mill residues based on the crop forecast for the next year, and set up a detailed monthly application programme in suitable blocks. When using OMP-FP to calculate mineral fertilizer recommendations, the user can choose to either ignore or take into account the nutrients contributed by mill residues. Our example shows that overall cost savings (after taking into account the cost of fertilizers and the application costs of fertilizer and mill residues) are about USD 64/ha.

Fertilizer substitution provides opportunities to reduce costs whilst maintaining nutrient supply but, in addition, leads to reduced fertilizer use and related CO2 emissions. OMP, OMP-CB and OMP-FP provide a set of powerful tools that make it much easier to set up programmes for the application of fertilizers and mill residues and investigate possible cost savings using site-specific assumptions.

5. Acknowledgements

We would like to thank Ocho Sur for permission to use their data to illustrate this paper.

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From the developers desk

A selection of the on-going developments and plans which are part of our constant efforts to continue to improve Agrisoft products.

Data analysis changes and new fields

- Block-level field for general harvest method used in this block
- Data analysis of productivity by harvest method
- Additional grouping level on monthly round lengths form
- Flexible filtering system with option to choose fields to include in filter
- Improved and more finely-grained data recalculation system
- Rule-based system for block-specific maturity ages
- New data analysis form for monthly block growth status and areas
- Additional grouping options on monthly fertilizer recommendation vs actual
- New and improved layout of block details form

Monthly areas and area in yield

- Dedicated field for “area in yield” for yield calculations
- Recording of block areas and palm census changes on a monthly basis
- Separate recording of high conservation value (HCV) areas
- Increased accuracy in all yield calculations on a monthly basis
- Better reporting of estate areas and areas in yield on a month-by-month basis
- Easier and more accurate handling of situations where blocks come into production or are replanted
- Support for week-based production recording in fiscal year settings
- Improved calculation of YTD and 12MRT yields in cases with non-constant area in yield

OMP GIS

- Completely new standalone thematic mapping application
- Independent of GIS host programs like ArcGIS and MapInfo
- C# application compatible with any normal Windows host
- Improved handling and management of yearly base maps
- Mapping using user-defined thematic ranges for all numeric parameters
- Point maps for geo-referenced OMP Field Survey results
- Continued support for custom background layers and exporting to PDF or Google Earth
- Cover all features of previous OMP-GIS, including multi-map layouts