Comparing spatial distribution of Histosols mapped in 1970’ with peat hydrological unit recentlydelineated at South Sumatera

M A Rais¹, F R Setyawardani², D T Suryaningtyas³, Darmawan³ and B Sumawinata³

¹ Student of Soil Agrotechnology Study Program, Graduate School, IPB University, Jl. Meranti, IPB Dramaga Campus, Bogor, Indonesia
² Student of Land Resource Management Study Program, Undergraduate School, IPB University Jl. Meranti, IPB Dramaga Campus, Bogor, Indonesia
³ Department of Soil Science and Land Resources, Faculty of Agriculture, IPB University, Jl.Meranti, IPB Dramaga Campus, Bogor Indonesia
basukis2@yahoo.com

Abstract. According to a survey of Tidal Rice Development (P4S) from IPB between 1974 and 1978, there was only 22.6% peatland area in South Sumatera. The P4S surveys were done at semi detail intensity (1:50.000) and carried out with intensive ground observation. Peatland area in the same region was also mapped into Peat Hydrological Map (KHG) in 2017. According to KHG maps, the peatland area in the region should have been larger than what P4S has surveyed. The peatland nearly impossible to expand in a short time, on the contrary, it might decrease. Hence, this study was aimed to compare peatland area from both maps above as a basis for the improvement of peat data. Peatlands were compiled from the results of the P4S surveys in South Sumatera, among others Sugihan Kiri, Air Saleh, Delta Upang, Musi Banyuasin, Calikin Calik, Karang Agung and Muara Padang which were then mapped into KHG. Both were processed with Geographic Information System (GIS) procedures. The overlay results show that the size from 16 KHG area of peat in the study area is 445,676 Ha, meanwhile based on the results of the P4S soil mapping is 137,670 Ha. It shows that KHG peat is much larger than the results of The P4S soil mapping, which is absolutely clearly, indicates the inaccuracy in withdrawing the KHG area boundaries in this region. Keywords: map of peatland, histosols, ground check survey, KHG map scale, soil mapping.

1. Introduction
Peatland utilization has made rapid progress, especially for oil palm plantations. This progress must be accompanied with knowledge about the characteristics and mapping of the peat area so the area can be used and managed properly. This is becomes more important because peatland in the future will be one of the choices amongst the increasingly limited resources. Therefore, an accurate map of the peatland area is needed to support the utilization and management of peatlands in Indonesia.

The extent and distribution of peat area in Indonesia among others, regulated by Indonesia’s Government Regulation (PP) number 71 of 2014 concerning the protection and management of peat ecosystems [1]. Furthermore the determination of the Peat Hydrological Peat ecosystem function map are mentioned Units map (KHG) and the establishment of a in the Environment and Forestry Ministry Regulation number 14 of 2017 that the KHG Map is a map that informs the location and extent of the...
peat ecosystem, while the peat ecosystem is an elemental orders of peat which is a whole area that influences one another in shaping their balance, stability, and productivity [2].

The 1:250.000 scaled KHG maps are designed based on BBSDLP-Ministry maps, hydrological maps or RBI river networks, land cover maps made from medium-resolution remote sensing images, Altitude Elevation Model Maps (DEM), and other valid sources in geo-spatial mapping methodology. Nevertheless, the KHG map is considered to still have many lack because there are still inaccuracies compared to the actual condition of peatlands. Inaccuracies in KHG map can be reviewed in several mapped areas by comparing peat distribution based on previous mapping, especially the Tidal Rice Development Project (P4S) results from 1974 to 1978.

Therefore, this paper intends to compare the results of the KHG mapping with the results of the P4S Survey at several locations in South Sumatra, which are the tidal areas of Sugihan Kiri, Air Saleh, Delta Upang, Musi Banyuasin, Calikin Calik, Karang Agung and Muara Padang. The maps produced from this research include the distribution and extent of organic soil (considered as peat at the time) that could be known with a level of accuracy 1:50.000.

The results of is comparison are expected to be very useful for policymakers to evaluate the importance of managing and utilizing peatland sustainably and as an effort to protect peatland and their ecosystems according to government regulations.

2. Material and Method

![Figure 1. Location of study area](image)

The materials used in this study composed from number of maps from the survey and sub-tidal areas mapping (P4S) in South Sumatra conducted at the semi-detailed level with 1: 50.000 scale map, location data, and maps had shown in table 2 and peat hydrological unit maps (1:250.000) obtained from the attachment to SKMENLHK No. 130/2017, NLP 1013 and 1113. Tools that was used for this research is a standard hardware and software for GIS, those are ArcView and GIS Arc. The main data analysis step was the overlay between the peat distribution map according to the P4S and the KHG maps.
Table 1. The study area and maps were used to see the distribution of peat from the results of the P4S soil mapping

| Region                  | Map Title                                      | Area (Ha) |
|-------------------------|------------------------------------------------|-----------|
| Sugihan Kiri            | Peta Tanah Semi Detail Area Air Sugihan–Kiri Skala 1:50.000 | 41120     |
| Air Saleh               | Peta PH Tanah Area Air Saleh Skala 1:200.000      | 134834    |
| Air Padang - Air Sugihan| Peta Tanah Semi Detail Area Air Padang-Air Sugihan Skala 1:50.000 | 24500     |
| Delta Upang             | Peta Ketebalan Gambut Area Delta Skala 1:200.000  | 28300     |
| Musi Banyuasin          | Peta Tanah Semi Detail Area Musi -Banyuasin Skala 1:50.000 | 85500     |
| Banyuasin Calik         | Peta Tanah Semi Detail Area Banyuasin- Skala 1:50.000 | 92800     |
| Karang Agung            | Peta Persebaran Tanah Gambut Area Karang Agung 1:500.000 | 2000000   |
| Jumlah                  |                                                | 607054    |

Overall the methodology for implementing the research steps is described as follows:

Figure 2. Steps of research
3. Result and Discussion

3.1. Map of peat distribution based on the results of P4S soil mapping

Peat distribution in the study area based on P4S mapping shown in figure 3. From the survey, it was found that the peat distribution in the study area was only found in certain locations and the other was mineral soil. In other word, it is concluded that there is a 137,670 hectares of peat (Histosols) or 22.6% of the total area. Peat areas based on P4S soil mapping presented in detail in table 2.

![Figure 3. Map of peat distribution based on the results of P4S soil mapping [1].](image)

Table 2. Compilation data of peat distribution based on P4S soil mapping [1].

| Code | Digitized     | Map Title                                                                 | Number of observation points | Soil Sample | Area (Ha) |
|------|---------------|---------------------------------------------------------------------------|-------------------------------|-------------|-----------|
|      |               |                                                                           | Profil | Drilling | Mineral | Peatsoil | Total    |
| A    | Sugihan Kiri  | Peta Tanah Semi Detail Area Air Sugihan–Kiri Skala 1:50.000              | 112    | 112      | NF       | 31937    | 9183     | 41120    |
| B    | Air Salaeh    | Peta PH Tanah Area Air Saleh Skala 1:200.000                              | 264    | 403      | 1272     | 98851    | 35983    | 134834   |
| C    | Air Padang -  | Peta Tanah Semi Detail Area Air Padang-Air Sugihan Skala 1:50.000       | 49     | 186      | 195      | 16810    | 7690     | 24500    |
|      | Air Sugihan   |                                                                           |                               |            |          |          |          |          |
| D    | Delta Upang   | Peta Ketebalan Gambut Area Delta Skala 1:200.000                         | NF     | NF       | NF       | 22180    | 6120     | 28300    |
| E    | Musi Banyuasin| Peta Tanah Semi Detail Area Musi - Banyuasin Skala 1:50.000             | 161    | 768      | 627      | 73056    | 12444    | 85500    |
| F    | Banyuasin Calik| Peta Tanah Semi Detail Area Banyuasin Calik - Skala 1:50.000           | 232    | 607      | 1069     | 62680    | 30120    | 92800    |
| G    | Karang Agung  | Peta Persebaran Tanah Gambut Area Karang Agung 1:500.000                | 180    | 671      | 766      | 163870   | 36130    | 200000   |
|      | Jumlah        |                                                                           |                               |            |          | 469384   | 137670   | 607054   |

* NF (Not Found)
3.2. Map of peat distribution according to KHG based on SKMEN No. 129/2017

The extent of peat distribution according to the KHG map in this study area is shown in figure 4. Based on the map, Peat distribution are pointed to 16 KHG locations which will be a study area for this research. From the calculation above, it is known that 16 KHG points/locations are 445,676 Ha. The 16 peat area are detailed in table 3.

![Figure 4. Map of national peat ecosystem KHG in the study area](image)

**Table 3.** Type of cultivation function area and protection function based on KHG in the study area

| Region            | Name of KHG                                             | Area (Ha) | Cultivated | Protect | Total |
|-------------------|---------------------------------------------------------|-----------|------------|---------|-------|
| Sugihan Kiri      | KHG Sungai Sugihan - Sungai Lumpur                      | 15612     | 25508      | 41120   |
| Air Saleh         | KHG Sungai Musi - Sungai Saleh                         | 12788     | 22998      | 35786   |
|                   | KHG Sungai Saleh - Sungai Sugihan                      | 15965     | 82995      | 98960   |
|                   | KHG Sungai Sugihan - Sungai Lumpur                      | 88        | 0          | 88      |
| Air Padang        | KHG Sungai Saleh - Sungai Batanghari                    | 15        | 0          | 15      |
|                   | KHG Sungai Saleh - Sungai Sugihan                      | 0         | 24417      | 24417   |
|                   | KHG Sungai Sugihan - Sungai Lumpur                      | 68        | 0          | 68      |
| Delta Upang       | KHG Aek Musi - Sungai Upang                            | 9689      | 15877      | 25566   |
|                   | KHG Delta Talang                                       | 1534      | 0          | 1534    |
| Banyuasin         | KHG Aek Sebatik - Aek Musi                             | 16668     | 14932      | 31600   |
|                   | KHG Air Banyuasin - Sungai Musi                        | 8643      | 2146       | 10789   |
| Banyuasin-Calik   | KHG Air Banyuasin - Air Lalang                         | 34078     | 25035      | 59113   |
| Karang-Agung      | KHG Sungai Bentayan - Sungai Penimpahan                 | 20172     | 18276      | 38447   |
|                   | KHG Sungai Ngirawan - Sungai Sembilang                  | 19        | 0          | 19      |
|                   | KHG Sungai Penimpahan - Sungai Air Hitam                | 8483      | 5887       | 14370   |
|                   | KHG Sungai Sembilang - Sungai Lalan                     | 32999     | 30785      | 63784   |
| **Jumlah**        |                                                         | **176820**| **268856** | **445676** |
3.3. Comparison of the area and distribution of peat according to KHG and P4S soil mapping

Overlay result between national peat ecosystem function of 16 KHG and peat distribution map based on P4S soil maps is shown in figure 5. The overlaying map clearly shows that the delineated areas as KHG both the function of peat for cultivation and the function of peat for conservation are much larger than peat coverage based on P4S soil map. The difference in the areas can be seen clearly on the overlapping map. The calculation results show that the difference in the peat area is 308,006 ha or 51% of the total study area or 250% much larger than peat coverage based on P4S soil map.

![Figure 5](image)

**Figure 5.** Overlapping maps of peat according to KHG and peat according to the results of P4S soil maps in study area.

One of the study areas mapped by P4S is Air Padang presented in figure 6. The areal study was mapped in 1974 in natural condition using realistic method (ground observation) with a grid system had shown in figure 7. It had done by observing the soil property at equal distance in particular path. The map clearly present high accuracy result and also shows that peat distribution is only in the middle part. How it is possible that natural peat was found to be much larger by lower intensity maps (1:250,000 KHG map) than by higher intensity maps (1:50,000 P4S maps). Thus it can be ascertained that the results of peat distribution mapping according to KHG are inappropriate, considered to be inaccurate and still have many weaknesses that has led to some problems.
Figure 6. Differences in peat area according to KHG and peat from P4S soil mapping in Air Padang area.

Figure 7. Soil observation technique in the P4S soil survey
Such difference in peat distribution data (map) definitely cause a difference in determining and apply the policy for the area so that it is necessary to review the KHG maps. The must implication an inaccurate peat distribution data that are attacked to a regulation such as for both conservation area and cultivation area according to KHG greatly will affects the tenure conflicts of peatland utilization by community, private company and the government as policymakers. According to [10] problems of land conflicts in peat areas occur mainly because the vagueness of the border.

4. Conclusion
Based on the results of the study, it can be concluded that there is a big different between peat distribution according to the 2017 KHG map and the peat distribution mapping by P4S in 1974 and 1978. This different is scientifically impossible. Then it is necessary to review the publication of peat distribution maps in Indonesia and need to put previous mapping result into consideration.

References
[1] Republik Indonesia. 2014. Peraturan pemerintah Republik Indonesia No. 71 Tahun 2014 tentang Perlindungan dan Pengelolaan Ekosistem Gambut. Jakarta (ID).
[2] Republik Indonesia. 2017. Keputusan Menteri Lingkungan Hidup dan Kehutanan Republik Indonesia. Nomor P.14/MENLHK/SETJEN/KUM.1/2/2017 tentang Tata Cara Inventarisasi dan Penetapan Fungsi Ekosistem Gambut.
[3] Tim Institut Pertanian Bogor.1975. Laporan survai dan pemetaan tanah Daerah Pasang Surut Musi Banyuasin sub P4S Sumatera Selatan, Institut Pertanian Bogor, Bogor (ID).
[4] Tim Institut Pertanian Bogor. 1976a. Laporan survai dan pemetaan tanah Daerah Pasang Surut Air Saleh sub P4S Sumatera Selatan, Institut Pertanian Bogor, Bogor (ID).
[5] Tim Institut Pertanian Bogor. 1976b. Laporan survai dan pemetaan tanah Daerah Pasang Surut Banyuasin Calik sub P4S Sumatera Selatan, Institut Pertanian Bogor, Bogor (ID).
[6] Tim Institut Pertanian Bogor. 1976c. Laporan survai dan pemetaan tanah Daerah Pasang Surut Delta Upang sub P4S Sumatera Selatan, Institut Pertanian Bogor, Bogor (ID).
[7] Tim Institut Pertanian Bogor. 1976d. Laporan survai dan pemetaan tanah Daerah Pasang Surut Delta Upang sub P4S Sumatera Selatan, Institut Pertanian Bogor, Bogor (ID).
[8] Tim Institut Pertanian Bogor. 1977. Laporan survai dan pemetaan tanah Daerah Pasang Surut Air Padang Air Sugihan sub P4S Sumatera Selatan, Institut Pertanian Bogor, Bogor (ID).
[9] Tim Institut Pertanian Bogor. 1978. Laporan survai dan pemetaan tanah Daerah Pasang Surut Karang Agung sub P4S Sumatera Selatan, Institut Pertanian Bogor, Bogor (ID).
[10] Osaki, Mitsuru, Nobuyuki Tsuji, 2016, Tropical Peatland Ecosystems, Springer, Japan. pp 49-58