Changes in dryland forest cover in several sub-districts in Deli Serdang Regency

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Abstract. Deli Serdang Regency is located in a strategic area because it surrounds Medan City. This study aimed to analyze changes in dryland forest land cover in Deli Serdang Regency, which is located in the up stream of the Belawan Watershed and the Deli Watershed for three time periods (2009, 2014, 2019) using the Geographical Information System (GIS). The results showed that during the period of 10 years 2009-2014-2009 the forest land cover in Deli Serdang Regency decreased from 19,517.58 ha in 2009 to 19,484.93 in 2014 and to 19,426.73 ha in 2019. Dryland forest land cover in several sub-districts in Deli Serdang Regency decreased. Hence, mixgardens, open land, cultivation, and shrubs become increased. In a period of 10 years, an area of 19,426.73 ha of dryland forest cover did not change, 26.80 ha become mixed gardens, 46.02 ha become open land, 5.85 ha become cultivation, and 12.18 ha become shrubs. There were five sub-districts with reduced forest land cover, namely: Gunung Meriah, Kutalimbaru, Sibolangit, STM Hilir, STM Hulu. Meanwhile, there were two sub-districts that have not changed, namely: Sibiru-biru and Bangun Purba.

1. Introduction
As mandated in the Sustainable Development Goals (SDGs), which is a global action plan agreed upon by world leaders, including Indonesia, to end poverty, reduce inequality and protect the environment, that is one of the 17 agenda for the SDGs 2015-2030 goals that were passed on 25 September 2015 by involving parties, such as: Government, Civil Society Organizations (CSO), the private sector, and academics are protecting, restoring and enhancing the sustainable use of terrestrial ecosystems, managing forests sustainably, stopping desertification, restoring land degradation, and stopping biodiversity loss) (Goal XV: Life on Land). According to the International Tropical Timber Organization (ITTO) [1], Sustainable Forest Management (SFM) is the process of managing forest land to achieve one or more clearly defined management objectives, which involve the production of desired forest products and services in a sustainable manner, without any significant impact. undesirable for both the environment and society, or a reduction in the value contained therein and its potential in the future. As an ecosystem, a forest is defined as a unitary ecosystem in the form of a stretch of land containing biological natural resources dominated by trees in their natural environment,
which cannot be separated from one another (Forest definition contained in Law 41/1999 concerning forestry), must be managed wisely and sustainably.

Forest area in Indonesia is approximately 120.6 million ha [2] or about 63% of the land area, consisting of production forests of 68.8 million ha, 57%, conservation forests of 22.1 million ha or 18% and forests protected area of 29.7 million ha or 25% of the total forest area in Indonesia. The area of forest area in North Sumatra Province based on (SK MENLHK No. SK.1076 Tahun 2017) which was revised by Decree No. 8088/MenLHK-PKTL/KUH/PLA.2/11/2018 dated 23 November 2018 concerning the development of forest area confirmation until 2017, is approximately 3,010,160.89 ha. Changes in forest area were caused by the process of gazettement of forest areas and adjustments to the coastal base, river, lakes, and provincial administrative boundaries. To achieve sustainable / sustainable forest management, it should be started from a good and precise forest planning supported by spatial technology and support from parties, especially the community in forest management. One of the activities in forest planning is to identify changes in forest land cover that occur within a certain time period.

The latest data and information regarding changes in land cover over a certain period of time, especially the dry land forests in the up stream watershed that occurred in Deli Serdang Regency, are needed. Several studies related to changes in land cover in several regions in Indonesia have been carried out [2-9], it is very important to know the dynamics of changing land changes that can be used in forestry planning. Considering the importance of data and information regarding changes in dryland forest land cover that occurred during a period of five years and ten years, this research is necessary. This study aimed to determine changes in land cover in several sub-districts in Deli Serdang Regency that have occurred during five years and ten years (2009-2014-2019). The results of this study are expected to be a guideline for the central government.

2. Materials and Methods
This research was conducted from January 2020 to August 2020. Research sites were conducted in several sub-districts in Deli Serdang Regency (Figure 1).

![Figure 1. Map of the Research Location](image-url)
Map processing, digitization, and data analysis were conducted at the Forest Inventory Laboratory, Forestry Study Program, Faculty of Forestry, Universitas Sumatera Utara, Medan. The materials used in this research are; digital map of the administration of Deli Serdang Regency, map of the forest area of North Sumatra province, 2009 land cover map, 2014 land cover map and 2019 land cover map. The tools used are computers, ArcGis software, Global Positioning System (GPS) and digital cameras. Overlay and change detection techniques available in geographic information system (GIS) applications were used to analyze land use changes (2009-2014-2019) [10-17]. Reduction or increase in forest land cover was calculated using Microsoft Office Excel. Interviews with key person and discussions with various stakeholders were also conducted to find out information about the factors that trigger changes in forest land cover.

3. Results and Discussion

The results of the analysis of land cover maps for 2009, 2014 and 2019, the dry land forest cover in Deli Serdang Regency can be seen in Table 1. Based on Table 1, there are seven sub-districts in Deli Serdang Regency that have dry land forest cover, namely: Bangun Purba, Gunung Meriah, Kutalimbaru, Sibiru-biru, Sibolangit, STM Hilir, STM Hulu. The largest forest land cover was in the STM Hulu Sub-district, namely 5,036.56 ha (25.81%) in 2009, 5,036.56 ha (25.81%) in 2014, and 5,007.97 ha (25.66%) in 2019, followed by Sibolangit Sub-district 25.32% in 2019, Gunung Meriah Sub-district 24.16% in 2019, and Kutalimbaru Sub-district 12.00%, and STM Hilir Sub-District 11.87% in 2019. The conditions of forest land cover in Kutalimbaru Sub-District, Deli Serdang Regency can be seen in Figure 2.

| Sub-districts   | Dryland forest area (ha) |
|-----------------|--------------------------|
|                 | 2009         | 2014         | 2019         |
| Bangun Purba    | 0.40         | 0.40         | 0.40         |
| Gunung Meriah   | 4,720.76     | 4,714.91     | 4,714.91     |
| Kutalimbaru     | 2,351.80     | 2,351.80     | 2,342.43     |
| Sibiru-biru     | 101.89       | 101.89       | 101.89       |
| Sibolangit      | 4,976.79     | 4,949.99     | 4,941.93     |
| STM Hilir       | 2,329.38     | 2,329.38     | 2,317.21     |
| STM Hulu         | 5,036.56     | 5,036.56     | 5,007.97     |
| **Total**       | **19,517.58**| **19,484.93**| **19,426.73**|

Figure 2. Condition of dry land forest in Kutilimbaru Sub-district, Deli Serdang Regency
Changes in land cover per district can be seen in Table 2,3,4. Based on Table 2, it can be seen that the forest land cover in Deli Serdang Regency in the period 2009 to 2014 there were two districts whose forest area was reduced, namely Gunung Meriah and Sibolangit. And five districts that have not changed, namely: Bangun Purba, Kutilambaru, Sibiru-biru, STM Hilir and STM Hulu.

Table 2. Changes of dryland forest area land cover in 2009 and 2014

| Sub-districts   | Dryland forest area (ha) | Changes             |
|-----------------|--------------------------|---------------------|
|                 | 2009                     | 2014                |                 |
| Bangun Purba    | 0.40                     | 0.40                | not change      |
| Gunung Meriah   | 4,720.76                 | 4,714.91            | change (decreased) |
| Kutilambaru     | 2,351.80                 | 2,351.80            | not change      |
| Sibiru-biru     | 101.89                   | 101.89              | not change      |
| Sibolangit      | 4,976.79                 | 4,949.99            | change (decreased) |
| STM Hilir       | 2,329.38                 | 2,329.38            | not change      |
| STM Hulu         | 5,036.56                 | 5,036.56            | not change      |
| **Total**       | **19,517.58**            | **19,484.93**       | change (decreased) |

Changes in land cover per district in 2014 and 2019 can be seen in Table 3. Based on Table 3, it can be seen that forest land cover in Deli Serdang Regency in the period 2014 to 2019 contained four sub-districts whose forest area was reduced, namely: Kutilambaru, Sibolangit, STM Hilir and Hulk STM and two sub-districts that have not changed, namely: Bangun Purba and Gunung Meriah.

Table 3. Changes of dryland forest area land cover in 2014 and 2019

| Sub-districts   | Dryland forest area (ha) | Changes             |
|-----------------|--------------------------|---------------------|
|                 | 2014                     | 2019                |                 |
| Bangun Purba    | 0.40                     | 0.40                | not change      |
| Gunung Meriah   | 4,714.91                 | 4,714.91            | not change      |
| Kutilambaru     | 2,351.80                 | 2,342.43            | change (decreased) |
| Sibiru-biru     | 101.89                   | 101.89              | not change      |
| Sibolangit      | 4,949.99                 | 4,914.93            | change (decreased) |
| STM Hilir       | 2,329.38                 | 2,317.21            | change (decreased) |
| STM Hulu         | 5,036.56                 | 5,007.97            | change (decreased) |
| **Total**       | **19,484.93**            | **19,426.73**       | change (decreased) |

Dry land forest cover in Deli Serdang Regency in the period 2009 to 2019, there are five sub-districts whose forest area has decreased, namely Gunung Meriah, Kutilambaru, Sibolangit, STM Hilir and STM Hulu. There are two sub-districts that have not changed, namely: Bangun Purba and Sibiru-biru Sub-districts (Table 4).

Based on Table 5, it can be seen that the forest area in Deli Serdang Regency decreased by 90.85 ha in a period of 10 years. The dry land forest cover based on the results of spatial analysis turned into mixed gardens, open land, cultivation, and shrubs. The area of dry land forest into mixed gardens is 26.80 ha, the area of dry land forest to open land is 46.02 ha, the area of dry land forest into cultivation is 5.85 ha, and the area of dry land forest into shrubs is 12.18 ha.

Based on its function, forests are divided into three, namely: protection forest, production forest and conservation forest. Production forest is a forest area that has the main function of producing forest products. Protected forest is a forest area which has the main function of protecting life support systems to regulate, prevent flooding, control erosion, prevent seawater intrusion and maintain soil fertility. Conservation forest is a forest area with certain characteristics, which has the main function of preserving plant and animal diversity and its ecosystem. Based on its function, the forest area in
Deli Serdang Regency, consists of nature reserve forest, protection forest, limited production forest and permanent production forest. The production forest area in Deli Serdang Regency is managed by the regional forest management unit I Stabat (KPH Wilayah I Stabat) production forest management unit V (KPHP Unit V), the Forestry Service of North Sumatra Province. Nature Reserve Forest is divided into three status forest areas, namely National Park (Taman Nasional Gunung Leuser), Nature Reserve (CA Sibolangit) and Wildlife Reserve (Suaka Margasatwa (Gading Langkat SM Karang Timur Laut) [18]. This forest area has an important value for Deli Serdang Regency as a wealth of biodiversity, conservation and a sustainable natural ecosystem cycle. Meanwhile, the function of protection forest is divided into 2 areas, namely mountainous areas (dry land forests) and coastal areas (mangrove forests). The land cover change matrix for 2009 - 2019 (10 years) can be seen in Table 5 and a map of changes in dry land forest cover for a period of ten years (2009-2019) can be seen in Figure 3.

### Table 4. Changes of dryland forest area land cover in 2009 and 2019

| Sub-districts   | Dryland forest area (ha) | Changes     |
|-----------------|--------------------------|-------------|
|                 | 2009                     | 2019        |               |
| Bangun Purba    | 0.40                     | 0.40        | not change    |
| Gunung Meriah   | 4,720.76                 | 4,714.91    | change (decreased) |
| Kutalimbaru     | 2,351.80                 | 2,342.43    | change (decreased) |
| Sibiru-biru     | 101.89                   | 101.89      | not change    |
| Sibolangit      | 4,976.79                 | 4,941.93    | change (decreased) |
| STM Hilir       | 2,329.38                 | 2,317.21    | change (decreased) |
| STM Hulu         | 5,036.56                 | 5,007.97    | change (decreased) |
| Total           | 19,517.58                | 19,426.73   | change (decreased) |

### Table 5. Land cover change matrix for 2009 - 2019 (10 years)

| Land cover in 2009 | Land cover in 2019 | Dry land forest area (2019) |
|--------------------|--------------------|-----------------------------|
| Dry land forest    | 19,426.73          | 19,426.73                   |
| Dry land forest area (2009) | 19,517.58 |

Land cover conditions in forest areas in Deli Serdang Regency based on analysis for five years (2014-2019) show that protected forests have forest vegetation cover of only 23% of the total protected forest. Limited production forests have forest vegetation cover of 49.9% of the total limited production forests, permanent production forests have forest vegetation cover of only 5.9% of the total permanent production forests and nature reserve forests have forest vegetation cover covering 85.9% of the total forest nature reserve [18]. From these data, it can be seen that the function of forest areas in Deli Serdang District needs reforestation to increase the vegetation. It is important because one of the functions of forests is to absorb carbon. Carbon dioxide (CO₂) is a greenhouse gas that can cause global warming. Absorption by vegetation is one way to reduce CO₂ emissions. In addition, forests are natural resources that can provide maximum benefit for the prosperity of the people. Therefore, it needs to be preserved.
Forests have many benefits and functions for human life, both direct and indirect benefits. Direct impacts from forests, such as: timber and non-timber (sap, medicines, and gums) and indirect benefits, such as: animal habitat, preventing erosion, regulating water management, recreation areas, education, defense and security. Forests as the capital for national development have various tangible benefits in the life of the Indonesian nation, both ecological benefits, socio-cultural benefits and economic benefits. For this reason, forests must be managed and managed, protected and used in a sustainable manner for the welfare of the community, both current and future generations. As one of the determinants of the life support system, forests have provided great benefits to mankind, so it needs to be preserved. Forests have a role as harmonizing and balancing the global environment, so that linkages with the international world are very important while still prioritizing national interests. forest resources must be protected and managed in order to provide sustainable results and benefits. Given the importance of the function of forests for human life, forests must always be preserved.

4. Conclusion
During the period of 10 years 2009-2014-2009, the area of dry land forest cover in Deli Serdang Regency decreased from 19,517.58 ha in 2009 to 19,484.93 in 2014 and to 19,426.73 ha in 2019. There are five sub-districts whose dry land forest area has decreased in Deli Serdang Regency in the period 2009 to 2019, namely: Gunung Meriah, Kutalimbaru, Sibolangit, STM Hilir and STM Hulu. The Sub- district that has not changed were Sibiru-biru Sub-district and Bangun Purba Sub-district.

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