

Profile: the Sesan Basin

The Sesan River Basin is an important trans-boundary tributary to the Mekong River, shared by Cambodia and Viet Nam. The 18,800 km² basin lies between the adjacent Sekong Basin to its north, and the Sre Pok to its south. Collectively, these basins are known as the 3S Basins, and form the largest and most important trans-boundary watershed of the Mekong River, contributing up to 20% of the Mekong's annual discharge and 15% of its life-giving sediment.

Overview



Location of the Sesan River Basin within the 3S Basins.

The Sesan covers less than a quarter of the 3S Basins. However, despite its relatively smaller size, the Sesan includes a range of important ecosystems and provides key natural resources and ecosystem services to residents within and downstream.

The eastern border of the basin in Viet Nam runs along the spine of the Annamite Mountains, reaching to within 75 km of the coastline. From its headwaters, the Sesan River flows for 415 km, eventually joining the

Sre Pok River in Cambodia. From there the combined rivers travel another 45 km to the mainstream Mekong River above the town of Stung Treng. The Sesan Basin primarily overlaps with the provinces of Gia Lai and Kon Tum in Viet Nam and with Ratanakiri and Stung Treng in Cambodia.

Sesan Basin, in figures

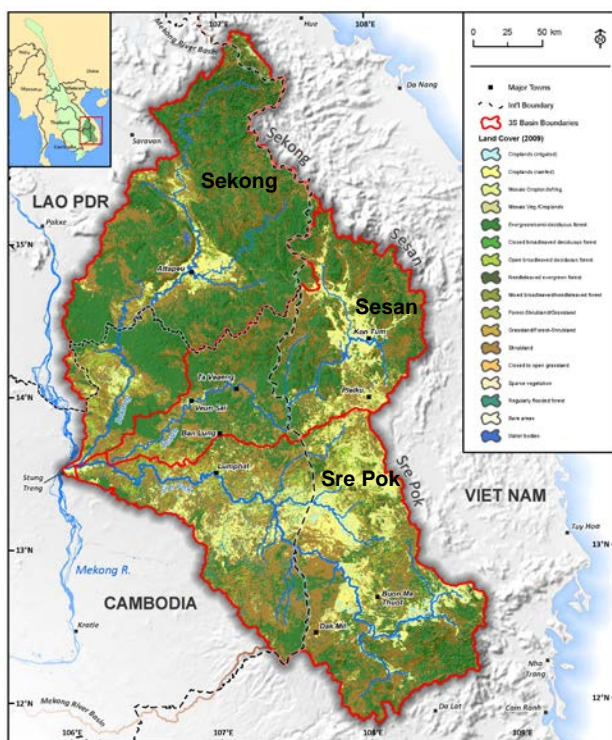
VARIABLE	COUNTRY	
	Cambodia	Viet Nam
Basin Area (km ²)	7,566	11,255
Basin Length (km)	130	140
Basin Width (km)	90	120
River Length (km)	225	237
Elevation Range (m)	56 – 1,434	129 – 2,390
Average Elevation (m)	273	778
Average Slope (deg.)	6	10
Provinces	Ratanakiri, Stung Treng	Gia Lai, Kon Tum
Major Towns	Ban Lung, Veun Sai	Kon Tum, Pleiku
Population (2012)	95,600	896,810
Pop. Density (pers./km ²)	13	80
Average Precip. (mm)	1,965	2,115
Average Temp. (°C)	22.6	19.3
Major Protected Areas	Virachey NP	Chu Mom Ray NP, Bac Plei Ku NR, KonKaKinh NP, Ngoc Linh (Kon Tum) NR

Climate

Precipitation within the Sesan Basin follows the same pattern as in the other 3S Basins, with lower temperatures and higher precipitation correlated with increasing elevation. The Sesan has an average annual temperature of 20.6 °C and mean annual precipitation of 1,934 mm.

However, these averages do not reflect large variations from month to month at different elevations. Climate is heavily influenced by the seasonal monsoon, and peaks in between July and September. In the lower portions of the basin around 1,900 mm of precipitation falls annually, with nearly 2,500 mm in its highest reaches.¹ This precipitation translates into high discharge, which rises from 250 m³ per second in March to around 4,500 m³/s in September.

Temperature varies widely between the upper and lower basins. Near the outlet of the Sesan, temperature can reach 35°C during the hottest months leading up to March and April. Parts of the upper basin are considerably more temperate, averaging around 20°C.²



Land cover in 2009. The upper Sesan has a large area under agricultural cultivation. Data: GlobCover2009.

Topography and land cover

The topography of the Sesan represents a transition between the steep and rugged Sekong, and the relatively flatter Sre Pok. The latest detailed land cover analysis for the Mekong was conducted in the year 2003 and showed natural forest covering nearly 63% of the Sesan Basin. This figure has since changed, with some natural forest areas being converted to plantations and other uses.³

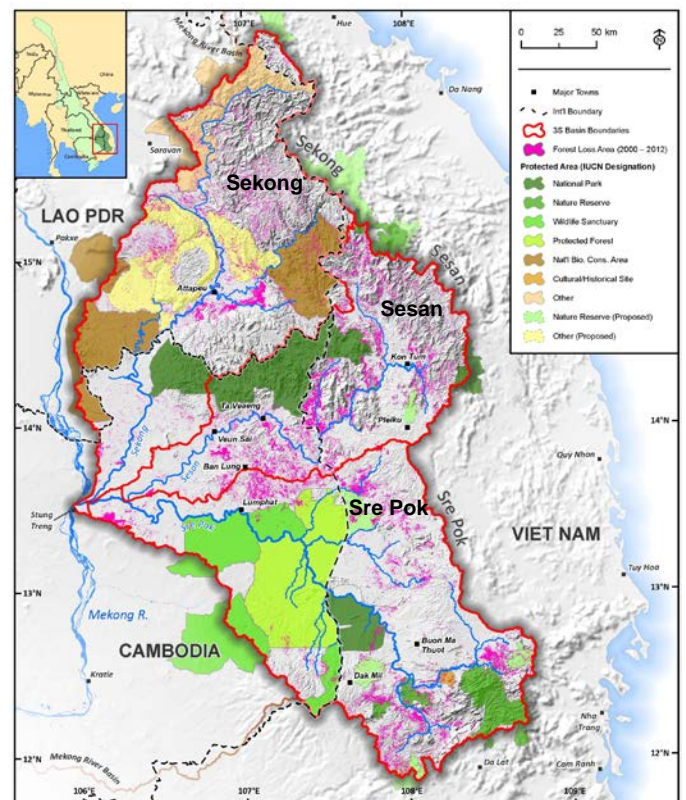
Of the three basins, the Sesan has experienced the highest relative amount of

deforestation. A recent study estimates that 9.5% of the basin's forests were lost between 2000 and 2012.⁴ Much of the land cover change has been caused by logging for timber, conversion of natural forest areas to industrial plantations, and expansion of agriculture. The creation of reservoirs for hydropower and irrigation purposes has also converted previously forested areas into open water.

Protected areas

Protected areas in the Sesan include Chu Mom Ray National Park, Virachey National Park (NP), Bac Plei Ku Nature Reserve (NR), and small overlaps with Kon Ka Kinh NP and Ngoc Linh (Kon Tum) NR. Virachey is the largest protected area within any of the 3S Basins, covering 3,368 km², 2,240 km² of which is within the Sesan. Although all of Virachey is within Cambodia, the park is adjacent to Mom Ray NR in Viet Nam and Dong Ampham protected area, in Lao PDR.

Together these three form a separate but contiguous protected area across all three countries. With the exception of Bac Plei Ku, all the aforementioned protected areas are also considered to be Key Biodiversity Areas⁵, Important Bird Areas, or both. The Sesan River riparian corridor is also classified as an important bird area in Cambodia.



¹MRC 2009. Lower Mekong Basin Historical Hydro Meteorology database.

²Hijmans et al. 2005.

³GMS-Environment Operations Center 2009.

⁴Hansen et al. 2013.

⁵ These are places of international importance for conserving biodiversity through protected areas and other methods, and are identified nationally using standard criteria.

Previous page: Protected areas and forest loss (purple) from 2001–2012. Large areas east of Virachey National Park and Ban Lung have been cleared and converted into tree plantations. Data: MRC 2009, Hansen et al. 2013, WDPA 2013.

Population

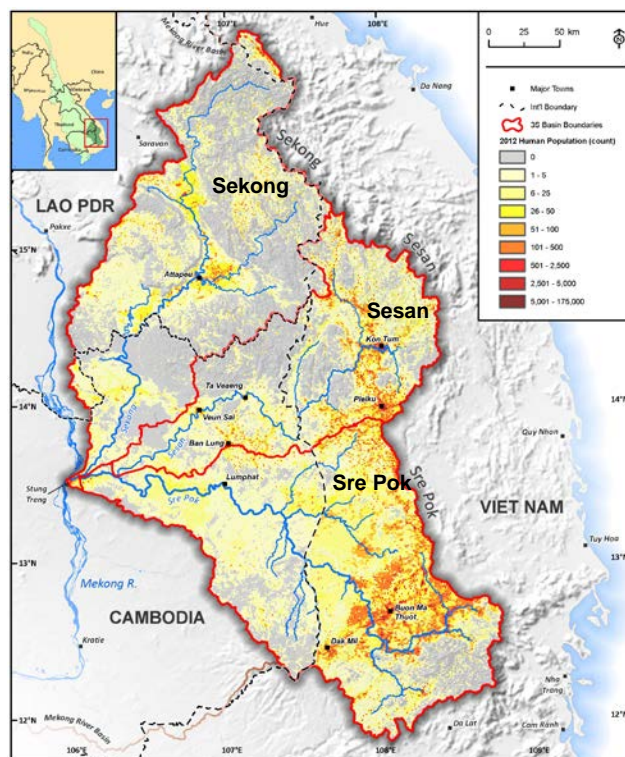
Human population is concentrated in valleys, along rivers, and in a few provincial cities. Approximately one million people live in the basin, with 90% of the population in Viet Nam. Population density is similarly divided, with less than 10 people/km² in much of Stung Treng and Ratanakiri provinces, while it exceeds 200 people/km² in Vietnam's Gia Lai Province.⁶ The population is overwhelmingly young and is growing rapidly. In Cambodia 43% under 15 years of age and the population here is predicted to double by the year 2060.⁷

Fisheries and agriculture

Fisheries in the Sesan are an important part of the economy. In the lower basin, fish catch, mainly dependent on capture fisheries, is reported to be declining. In the upper basin in Viet Nam, the economic value of fish production has increased, much of this due to investments in breeding. In Gia Lai Province fishery is estimated to have brought in almost USD4 million in 2010, an increase of more than 680% from just four years earlier.⁸ Although quickly growing, this represents a relatively small number compared to other sectors, such as agriculture, which earned more than USD750 million for Gia Lai in 2010.⁹

At least 89 (66%) of the fish species found here are migratory and depend on connectivity to adjacent areas.¹⁰ Furthermore, these migratory species make up 60% of total catch.¹¹ River communities in the Sesan River depend heavily on fish as a source of protein and, in some areas, for a significant part of their income.

Agriculture is the most widely practiced livelihood in the Sesan and crops include rice, taro, cassava, coffee, orchards (e.g. cashew and mango), and cash crops such as rubber.¹² In Cambodia a lack of irrigation infrastructure means crops such as rice are not planted on a large scale during the dry season. In the Cambodian portion of the 3S (including areas in the Sekong and Sre Pok), it is estimated that annual revenue related to the river basin is at USD10 million, of which 91% comes from



Population in the 3S Basins. The Sekong has the lowest population, at around 7% of the total in the 3S Basins. Data: LandScan 2012.

freshwater fisheries. By contrast, irrigated rice production was estimated to bring in less than USD120,000 per year, or just over 1% of revenue for the area.¹³

Hydropower

Already experiencing electricity shortages, both Cambodia and Viet Nam have eyed hydropower as a source of power. Viet Nam has already constructed a cascade of dams in the Sesan, including the 720 MW Yali Falls dam built in 1996.

Cambodia's National Strategic Development Plan (2009-2013) aims to bring electricity to 100% of villages by 2020. In practice this has meant a strong focus on hydropower. If it meets its target, nearly 70% of Cambodia's power production capacity will come from hydropower, much of it in the northeast, including areas in the Sesan Basin.

Currently, there are eight moderate to large hydropower dams already in the basin, with one under construction in Cambodia and more under consideration for the future. At least another 238 "hydrologic-related structures", such as weirs and small to medium reservoirs, have also been constructed in the upper Sesan.¹⁴

⁶ Hong et al. 2013.

⁷ CNMC 2011, pg. 80.

⁸ Someth et al. 2013.

⁹ Ibid.

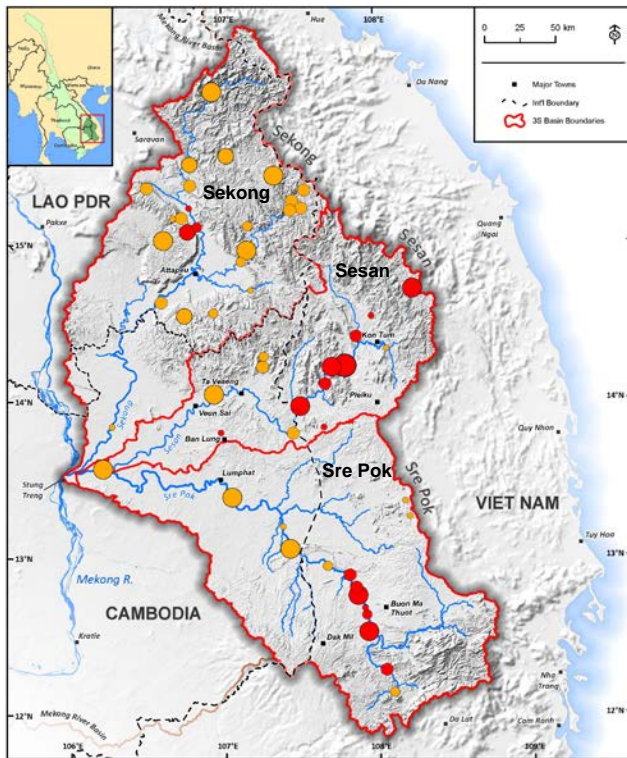
¹⁰ Baran et al. 2011.

¹¹ Ibid.

¹² Someth et al. 2013.

¹³ CNMC 2011, pg. 50.

¹⁴ Viet Nam National Mekong Committee. (2003). Analysis of Sub-Area 7V. Basin Development Plan.



Existing (red) and planned or under construction (orange) hydropower dams. Size represents relative production capacity. Data: MRC 2009.

State of water resources

In recent years the amount of water in the Sesan River has changed both seasonally and overall. This is a result of: 1) abstraction of water from the river for use in irrigation (much of which is lost to evapotranspiration), and 2) a shift in flow patterns resulting from dams (hydropower and irrigation). These trends have been driven by an intensification of agriculture (increased number of annual crops and shift from dryland to irrigated agriculture), and to a minor degree, from population growth and development of urban areas and industrial estates.^{15 16} Groundwater resources are not well understood, but are believed to be rapidly declining in many areas.¹⁷

Legal framework and key institutions

Key institutions governing water resources include the Ministry of Natural Resources and the Environment (MONRE) in each country, the Ministry of Agriculture and Rural Development (MARD) in Viet Nam, and the Ministry of Agriculture and Forestry in Cambodia.

A variety of laws on environment, water resources, fisheries, and strategic development plans influence water resources, but have only domestic jurisdiction. The main official mechanism for intergovernmental cooperation

within the Mekong Basin is the Mekong River Commission.

However, there is no substantive, basin-specific agreement governing water resources management or development in the Sesan. As such, diplomatic channels are critical for managing trans-boundary water resources.

In August 2014, the UN Water Courses Convention (UNWC)¹⁸ came into force after Viet Nam became the 35th signatory. The convention does not take direct effect in the 3S Basins until a neighbouring country also ratifies it. However, the UNWC could play an important role in future developments in the region by providing guiding principles while respecting the 1995 Mekong Agreement.

Threats and emerging issues

Portions of the Sesan Basin have undergone rapid development in recent years, leading to changes in land cover, water resources, and environmental services. Much of the attention has focused on the construction of dams, especially large hydropower dams, which have affected the flow regime of the Sesan River and could potentially impact areas as far downstream as the Mekong Delta, as well as fisheries upstream on the mainstream of the Mekong River. While these dams provide much-needed power and investment, they could also trap sediment and block fish migration.

The expansion of industrial plantations and filling reservoirs for dams has altered areas of the Sesan. The expansion of other agricultural crops has added to this conversion, and is thought to be depleting groundwater resources.

Mining is also a concern for potential impacts to water quality and land cover. The Sesan has deposits of bauxite, silver, and sapphire, which so far have not yet been extensively exploited. In addition, a large area north of the Sesan River has been identified as of particular interest for gold mining. If this area is more fully developed it could result in negative impacts to downstream water quality, primarily from runoff of cyanic acid and mercury.¹⁹

¹⁵ADB 2010.

¹⁶Cochrane 2010.

¹⁷CNMC 2011, pg. 19.

¹⁸UNWC, formally titled the "U.N. Convention on the Law of Non-Navigational Uses of International Watercourses."

¹⁹CNMC pg. 74.

References and further reading

Arias, M.E., Piman, T., Lauri, H., Cochrane, T.A., and Kummu, M. (2014). Dams on Mekong tributaries as significant contributors of hydrological alterations to the Tonle Sap Floodplain in Cambodia, *Hydrol. Earth Syst. Sci. Discuss.*, 11, 2177-2209.

Asian Development Bank (ADB). (2010). Sesan, Sre Pok, and Sekong River Basins Development Study in Kingdom of Cambodia, Lao People's Democratic Republic, and Socialist Republic of Viet Nam.

Baran, E., Saray Samadee, Teoh Shwu Jiau, Tran Thanh Cong. (2011). Fish and fisheries in the Sesan River Basin - Catchment baseline, fisheries section. Project report. Mekong Challenge Program project MK3 "Optimizing the management of a cascade of reservoirs at the catchment level". WorldFish Center, Phnom Penh, Cambodia. 61 pp.

Cambodia National Mekong Committee (CNMC). (2011). Profile: Sub-area Sekong-Se San-Sre Pok Cambodia (SA-7C) (Unpublished draft: April 2011).

Cochrane, T. A., Arias, M. E., Teasley, R. L., & Killeen, T. J. (2010). Simulated changes in water flows of the Mekong River from potential dam development and operations on the Se San and Sre Pok tributaries.

Economic Consulting Associates. (2010). The Potential of Regional Power Sector Integration: Greater Mekong Sub-region (GMS) Transmission & Trading Case Study. London, 99 pps.

GlobCover. (2009). <http://due.esrin.esa.int/globcover/>. Global Land Cover Map for 2009 (GlobCover 2009). European Space Agency (ESA) & Université catholique de Louvain (UCL).

Hijmans et al. (2005). WorldClim Database. www.worldclim.org. Accessed 18 February 2014.

Hong Troung et al. (2013). Basin Profile of the Upper Sesan River. Project report: Challenge Program on Water & Food Mekong project MK3 "Optimizing the management of a cascade of reservoirs at the catchment level". ICEM – International Centre for Environmental Management, Hanoi Vietnam, 2013.

LandScan. (2012). <http://web.ornl.gov/sci/landscan/>.

MRC. (2009). MRC Master Catalogue. <http://portal.mrcmekong.org/master-catalogue>.

Nagy, E. A., Maluski, H., Lepvrier, C., Schärer, U., Thi, P. T., Leyreloup, A., & Van Thich, V. (2001). Geodynamic Significance of the Kontum Massif in Central Vietnam: Composite 40Ar/39Ar and U-Pb Ages from Paleozoic to Triassic. *The Journal of Geology*, 109(6), 755-770.

Someth, P. et al. (2013). Basin Profile of the Lower Sekong, Sesan and Srepok (3S) Rivers in Cambodia. Project report: Challenge Program on Water & Food Mekong project MK3 "Optimizing the management of a cascade of reservoirs at the catchment level". ICEM – International Centre for Environmental Management, Hanoi Vietnam, 2013.

Viet Nam National Mekong Committee (VNMC). (2010). Update of Sub-Area Profile: Sub-area 7V. Hanoi.

UNWC. (1997). <http://legal.un.org/avl/ha/clnuiw/clnuiw.html>

BRIDGE:

Building river dialogue and governance

This publication is produced as part of the IUCN BRIDGE project in the Mekong 3S.

IUCN (International Union for Conservation of Nature), under the umbrella of the Building River Dialogue and Governance (BRIDGE) project supported by the Swiss Agency for Development and Cooperation (SDC), seeks to facilitate cooperative processes in the 3S region by developing and strengthening water governance capacities through governance reforms, stakeholder dialogues and knowledge exchange programmes.

For more information

Raphaël Glémet

Senior Programme Officer, Water and Wetlands

E-mail: raphael.glemet@iucn.org

IUCN Asia Regional Office (ARO)

Websites

BRIDGE 3S Basins website: www.3sbasin.org

IUCN BRIDGE websites: www.iucn.org/bridge

www.iucn.org/about/union/secretariat/offices/asia/regional_activities/bridge_3s/

About IUCN

IUCN helps the world find pragmatic solutions to our most pressing environment and development challenges.

IUCN's work focuses on valuing and conserving nature, ensuring effective and equitable governance of its use, and deploying nature-based solutions to global challenges in climate, food and development. IUCN supports scientific research, manages field projects all over the world, and brings governments, NGOs, the UN and companies together to develop policy, laws and best practice.

IUCN's Asia Regional Office is located in Bangkok, Thailand, with country, programme and liaison offices in Bangladesh, Cambodia, China, India, Lao PDR, Nepal, Pakistan, Sri Lanka, Thailand and Viet Nam.

www.iucn.org

www.iucn.org/asia

Facebook: [iucn.asia](https://www.facebook.com/iucn.asia) Twitter: [iucnasia](https://twitter.com/iucnasia)