XXII INQUA INDIA 2027

QUATERNARY SCIENCE AS SOCIETAL SERVICES




# XXII INQUA INDIA 2027

## FIELD GUIDE

### INMID - 12

FROM ALLUVIAL PLAINS TO CONSERVATION FRONTLINES: QUATERNARY GEOMORPHOLOGY, BIODIVERSITY, AND APPLIED SCIENCE AT THE KUKRAIL AND CIMAP, LUCKNOW







Shilpa Pandey, Parminder Ranhotra and Anumeha Shukla

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# INQUA INDIA 2027

## Field Guide Book

### INMID-12

## From Alluvial Plains to Conservation Frontlines: Quaternary Geomorphology, Biodiversity, and Applied Science at the Kukrail and CIMAP, Lucknow


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# Team Leaders



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Dr. Shilpa Pandey is a Quaternary palaeoscientist specializing in palynology, palaeoecology, vegetation–environment relationships and long-term ecosystem change. Based at the Birbal Sahni Institute of Palaeosciences, Lucknow, she has extensive experience in modern pollen studies, palaeoenvironmental reconstruction and field-based ecological interpretation across diverse Indian landscapes. Her research integrates modern vegetation, pollen assemblages and sedimentary archives to understand environmental and climatic change through the Quaternary. As Vice-President of the INQUA Coastal and Marine Processes Commission (2023–2027), she brings international scientific leadership and field-training experience. Her expertise in regional vegetation, palaeoecology and environmental change provides a strong scientific basis for interpreting the Kukrail and CIMAP field sites during the INQUA 2027 programme.



**Dr. Parminder Singh Ranhotra**

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Dr. Parminder Singh Ranhotra, Scientist-E at the Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow, is specializing in palaeovegetation and palaeoclimate reconstruction of the Himalayan region. His research integrates pollen–spore analysis of temperate to subalpine lacustrine and peat archives, and tree-ring studies of the Himalayan conifers and broadleaf species. His expertise in dendroecology and dendrogeomorphology encompasses forest age–stand structure, treeline dynamics, climate–growth relationship assessments, and reconstruction of past geohazards events for ecological sustainability and risk management. He has published extensively in SCI-indexed journals, participated in national and international scientific forums, and successfully executed sponsored research projects, contributing to multidisciplinary understanding of Himalayan environmental and climate change.



**Dr Anumeha Shukla**

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Dr Anumeha Shukla (Scientist E) is a palaeobotanist with over 15 years of research experience in plant palaeontology, palaeoclimate, and palaeobiogeography. She is associated with the Birbal Sahni Institute of Palaeosciences (BSIP), Lucknow, India, where her work focuses on Cenozoic plant diversity and evolution. Her research explores the evolution and diversification of angiosperms by studying plant megafossils from the Indian subcontinent. She uses fossil floras to reconstruct past vegetation and climate and to investigate floristic exchanges and palaeobiogeographic connections among continents. Her expertise includes qualitative and quantitative palaeoclimate reconstruction, palaeobiogeography, and the evolutionary history of basal angiosperms.

# Abstract

The Indo-Gangetic Plain is one of the most extensive Quaternary depositional systems on Earth, shaped by Himalayan tectonics, monsoonal variability, and millennia of human occupation — yet a persistent research challenge remains: linking its geological archives convincingly to the dynamics of living ecosystems. This one-day excursion addresses that gap by pairing two complementary sites within a single urban transect of the Middle Ganga Plain: Kukrail Reserve Forest, an urban ecological refuge developed on the Newer Alluvium (Khadar) floodplain of the Kukrail river, and the Central Institute of Medicinal and Aromatic Plants (CIMAP), situated on the older Bhangar surface.

Delegates will examine the regional stratigraphic framework (Older versus Newer Alluvium), observe active fluvial and pedogenic processes along the Kukrail riverbank, and visit the Kukrail Gharial Rehabilitation Centre- an ex-situ conservation programme for a relict Quaternary reptilian lineage with a documented Siwalik–Gangetic fossil record. At CIMAP, the excursion turns to the applied side of the same alluvial soil–climate system, where germplasm conservation and essential-oil research exemplify modern agro-biotechnology built on Quaternary landscape resources.

Framed against the Congress's focal theme, Quaternary Science as Societal Services, the excursion offers a living, single-day analogue for processes — channel migration, floodplain evolution, soil development, and ecosystem response to disturbance — that are typically studied only through cores and outcrops elsewhere in the basin. Discussion will highlight outstanding research questions spanning INQUA's SACCOM, PALCOM, TERPRO, and HABCOM commissions, including floodplain chronology, conservation genetics, and the environmental impact assessment of ecotourism development. Expect easy walking on level, well-maintained paths, cool, dry winter conditions, and rich opportunities for wildlife and field photography.

# Preamble

The Indo-Gangetic Plain represents one of the most extensive Quaternary depositional systems on Earth, its landscape sculpted by the combined action of Himalayan tectonics, monsoonal variability, fluvial dynamics, and millennia of human occupation. The Lucknow region, situated within the Middle Ganga Plain, offers an exceptional natural laboratory for examining the interaction between geological processes and ecological evolution over Quaternary timescales.

Globally, the Earth's Quaternary period is recognised as a critical interval of repeated climatic fluctuations, ecosystem transition and intensifying human-environment interaction. Understanding Quaternary landscapes is fundamental not only to reconstructing past environmental change but to anticipating future climate scenarios and designing effective conservation strategies. River plains, wetlands, forests, and other terrestrial ecosystems worldwide are under mounting pressure from increasing temperature variability, shifting monsoon behaviour, biodiversity decline, land-use transformation, groundwater stress, habitat fragmentation and disturbance of the carbon cycle.

Quaternary archives preserved in sediments, soils, pollen assemblages, organic matter and geochemical signatures provide the principal physical evidence of these past environmental changes. Yet a persistent and significant research challenge remains: linking these geological archives convincingly with the dynamics of modern, living ecosystems, so that paleoenvironmental insight can meaningfully inform present-day conservation and land-management decisions.

**Why this transect is unique**

The Kukrail field transect is distinctive in offering, within a single accessible urban setting, a working modern analogue for processes that Quaternary scientists typically study only through the indirect evidence of cores, outcrops and dated sections. As an urban ecological refuge developed on the Indo-Gangetic alluvial landscape, it allows delegates to observe fluvial geomorphology, floodplain evolution, soil formation, vegetation succession, and active conservation science operating together in real time on a substrate shaped by the very Quaternary processes the Congress addresses.

This integration is reinforced by pairing the Kukrail site with the Central Institute of Medicinal and Aromatic Plants (CIMAP), where plant genetic resources, medicinal-plant conservation, and climate-resilient agriculture demonstrate how the same alluvial soil-climate system is actively managed for biodiversity-based scientific and economic applications. Together, the two stops illustrate vegetation-climate interaction, ecosystem response to disturbance and conservation practice under sustained urban pressure, providing a coherent, modern analogue for the relationship between natural Quaternary archives and present-day ecological resilience and underscoring why integrated geological-ecological transects of this kind are increasingly valuable to the global Quaternary research community.



*Fig 1. Scientific and ecological landscape of CSIR–CIMAP, Lucknow (a) Green-covered walkway integrating sustainable campus infrastructure. (b) Landscaped plant-rich campus showcasing medicinal-plant conservation and biodiversity.*

# Regional Geology

**Location and Geographical Setting**

Lucknow is located in Uttar Pradesh, in the central sector of the Ganga Plain, at approximately 26 °- 27°N, 80°- 81°E, and 27 °- 28°N, 80 °- 81°E. The city lies within the Middle Ganga Plain, one of the world's largest Quaternary depositional basins, built almost entirely from sediment derived from the Himalayan orogen. Its principal landscape elements include the Gomti River and its tributary, the Kukrail River, together with extensive alluvial plains, palaeochannels, active and abandoned floodplain deposits and a mosaic of urban ecological patches developed on this alluvial substrate.

**Stratigraphy**

Lucknow lies within the Central Ganga Plain, a foreland basin containing a thick, locally exceeding 500 m sequence of Cenozoic fluvial sediments derived from the Himalaya. The sequence is dominated by sand, silt, and clay, interbedded with palaeosol horizons that record episodes of landscape stability and soil formation between successive phases of active deposition.

The Quaternary fill is conventionally divided into two principal lithostratigraphic units:

- **Older Alluvium** (Pleistocene): locally termed the Varanasi Older Alluvium; oxidised, calcrete-bearing silty clays and sands with well-developed soil horizons and weathering profiles, forming the elevated Bhangar surface.
- **Newer Alluvium** (Late Pleistocene–Holocene): unoxidised grey silts, sands, and clays of the active and recently abandoned floodplains, forming the lower-lying Khadar surface.

The Kukrail river and its forested corridor are developed on the Newer Alluvium / Khadar-type surface, whereas the CIMAP campus and much of urban Lucknow occupy the slightly higher, older Bhangar surface. This contrast is directly observable across the two excursion stops and offers delegates an unusually clear field illustration of the regional stratigraphic framework.

**Structure**

The Ganga Plain is a flexural foredeep underlain by the Indian shield basement, with basement depth increasing northward toward the Himalayan front. Structurally, the basin behaves as a passive, gently north-dipping, half-graben-style depression infilled by alluvium. Deformation in the immediate Lucknow area is subdued relative to more tectonically active marginal zones such as the faulted blocks documented farther east in the Sone–Ganga tract, although subtle neotectonic warping has been proposed elsewhere in the basin to account for local drainage anomalies and terrace offsets. Superimposed on this structurally quiescent setting, active geomorphic processes associated with the present river systems-channel migration, avulsion and floodplain reworking continue to shape the landscape.

### Palaeontology

The broader Quaternary sequence of the Ganga Plain has yielded vertebrate fossil remains, including proboscidean and bovid material, together with extensive palynological and phytolith records used to reconstruct Late Pleistocene-Holocene vegetation and monsoon history. At the local scale, the living gharial (Gavialis gangeticus) population maintained at Kukrail is best understood as a present-day representative of a much older Gavialis lineage with a documented Siwalik-Gangetic fossil record. This provides a direct conceptual link between the site's active conservation programme and the basin's deeper vertebrate palaeontological record.

### Quaternary Geology and the Place of This Excursion

The Quaternary sequence of the Middle Ganga Plain holds broad significance for reconstructing past monsoon variability, understanding river migration and floodplain evolution, and developing palaeoenvironmental proxies more generally. This excursion is situated squarely within the depositional domain of the Newer Alluvium. The Kukrail river channel, its associated point bars, and its seasonally inundated margins function as modern analogues for the fluvial processes that built the Late Quaternary floodplain sequences studied throughout the wider basin.

Accordingly, the field area gives delegates a rare opportunity to examine, within a single transect, the relationship between long-term geological history and present-day ecological pattern. It offers a living, observable proxy for geomorphic processes, channel migration, overbank deposition, and soil/calcrete formation on terrace risers that are elsewhere accessible only through borehole or outcrop study, making this excursion a valuable complement to the more conventional stratigraphic-section field trips offered elsewhere in the Congress programme.

## Flora, Fauna, and Climatic Conditions During the Field Excursion

### Ecosystem Context

Kukrail Reserve Forest is a sub-tropical dry deciduous plantation forest with riparian influence, established in the 1950s over roughly 5,000 acres along the Kukrail river. Beyond its conservation role, the forest provides important ecosystem services for the city, including carbon storage, groundwater recharge, and urban climate regulation, and functions as a key site for ecological education, conservation awareness, and applied research.




*Fig. 2 (a): Gateway to Kukrail Reserve Forest — a key site for in-situ conservation, crocodile rehabilitation, and urban forestry near Lucknow.*




*Fig. 2 (b): Bamboo-crafted eco-art structure at Kukrail Forest, showcasing sustainable landscaping and community engagement in forest conservation.*

**Flora**

The forest supports a diverse vegetation assemblage spanning planted forest stands, riparian vegetation along the Kukrail river, dedicated restoration zones, and nurseries of medicinal and economically important species. Dominant and characteristic taxa include:

- Teak, peltophorum, acacia, and Prosopis juliflora
- Neem (Azadirachta indica)
- Peepal (Ficus religiosa) and Banyan (Ficus benghalensis)
- Shisham (Dalbergia sissoo) and Babool (Vachellia nilotica)
- Mango, eucalyptus, Holoptelea integrifolia, date palm, and Ficus infectoria, together with a ground layer of grasses and shrubs

The forest department maintains dedicated herbal, medicinal, and sapling nurseries within the reserve, while the adjoining CIMAP campus and field stations hold germplasm collections and experimental plots of medicinal and aromatic species — mints, basils, lemongrass, and other essential-oil-bearing plants — reflecting the institute's agro-technology research programme. Vegetation structure, pollen assemblages, and soil organic matter at this site provide useful ecological indicators that link present plant communities to the Quaternary depositional setting.



*Fig. 3: Duckweed and algal bloom on a stagnant forest pond, indicating nutrient enrichment within Kukrail Reserve Forest's aquatic habitat.*

## Fauna

Kukrail is one of Lucknow's most important urban biodiversity refuges, particularly valued for its herpetofaunal conservation and avian diversity. The forest and its associated wetlands support over 200 resident and migratory bird species, with peak birding activity from March to April; bird communities here serve as useful indicators of ecosystem health. The reserve also hosts a deer park with spotted deer and blackbuck, and a rich herpetofauna of at least 39 recorded amphibian and reptile species — including 14 frog species, two turtle species, eight lizard species, and 14 snake species — several of which are listed as near-threatened or vulnerable on the IUCN Red List.



*Fig 4: Tree-lined pathway within Kukrail Reserve Forest, showcasing planned plantation and visitor infrastructure for eco-tourism and recreation.*




*Fig 5: Wildlife Museum at Kukrail Reserve Forest, spotlighting the reserve's flagship Gharial conservation legacy and native faunal diversity.*



*Fig 6: Rhesus macaque (Macaca mulatta) mother and infant at Kukrail Reserve Forest, reflecting the reserve's role as a thriving primate habitat.*



*Fig 7: Gharial (Gavialis gangeticus), a Critically Endangered species, basking at Kukrail Reserve Forest's Gharial Rehabilitation Centre -Asia's first successful captive-breeding programme for the species.*



*Fig 8: In vitro plant tissue culture repository at CSIR-CIMAP, Lucknow — a controlled micropropagation facility enabling large-scale, disease-free clonal multiplication of elite medicinal and aromatic plant germplasm.*

The site's principal conservation flagship is the Kukrail Gharial Rehabilitation Centre, established in the 1970s for the captive breeding and release of the critically endangered gharial (Gavialis gangeticus); several thousand captive-bred juveniles have been released into rivers including the Chambal, Ganga, Ghaghara, Sharda, and Ramganga. The centre additionally provides veterinary care and rehabilitation for rescued mugger crocodiles (Crocodylus palustris) and supports freshwater turtle conservation, underscoring the broader ecological importance of the site's riverine and wetland habitats. Butterflies, pollinating insects, and small mammals complete the faunal assemblage, contributing to food-web stability, pollination, nutrient cycling, and natural pest regulation within the reserve.




*Fig 9: Nature Interpretation Centre at Kukrail Reserve Forest, its gharial-jawed entrance symbolizing wildlife conservation education.*

**Climate and Weather During the Excursion (28 January – 3 February 2027)**

Lucknow has a sub-tropical climate with a hot, dry summer, a monsoon season from July to September, and a cool, dry winter. The Congress excursion falls within this winter window, the most favourable period of the year for field observation. Delegates should expect:

- Daytime temperatures of approximately 15–22°C, with overnight/early-morning lows around 6–10°C
- Generally clear to partly hazy skies, with the possibility of morning fog
- Negligible rainfall and light winds, giving good visibility for fieldwork and photography
- Cool mornings warming through the day — layered clothing is recommended (see Section 12, Dos and Don'ts)

These conditions are well suited to outdoor field activity, wildlife observation, and site-based discussion throughout the excursion.

# Literature Review

**Research Publications Available**

The Ganga Plain has long been a focus of Quaternary research, and a substantial body of published work underpins the scientific framing of this excursion:

- Regional Quaternary stratigraphy and geomorphology of the Ganga/Indo-Gangetic Plain, including the Older/Newer Alluvium lithostratigraphic framework and the Bhangar–Khadar surface classification, documented in Geological Survey of India studies (GSI) and synthesised by Singh (1996).
- Late Quaternary alluvial stratigraphy and luminescence-based chronologies of the Ganga Plain, addressing basin evolution, terrace formation, fluvial sedimentation, palaeosol development, and palaeo-monsoon reconstruction (Srivastava et al., 1994; Gibling et al., 2005; Tandon et al., 2008; Srivastava et al., 2010).
- Soil–geomorphology and pedogenic studies of the Indo-Gangetic alluvial plains, including clay-mineral evidence of Holocene climatic change (Srivastava et al., 1998; Pal et al., 2009) and characterisation of arsenic-bearing palaeochannel sediments in the Middle Ganga Plain (Kumar et al., 2010).
- Conservation biology and herpetological literature on Gavialis gangeticus recovery programmes (Whitaker & Basu, 1983; Choudhury & de Silva, 2013), biologging studies of free-ranging gharial behaviour (Stoeckle et al., various years) and amphibian/reptile biodiversity surveys specific to Kukrail Reserve Forest (UP Forest Department, annual reports).

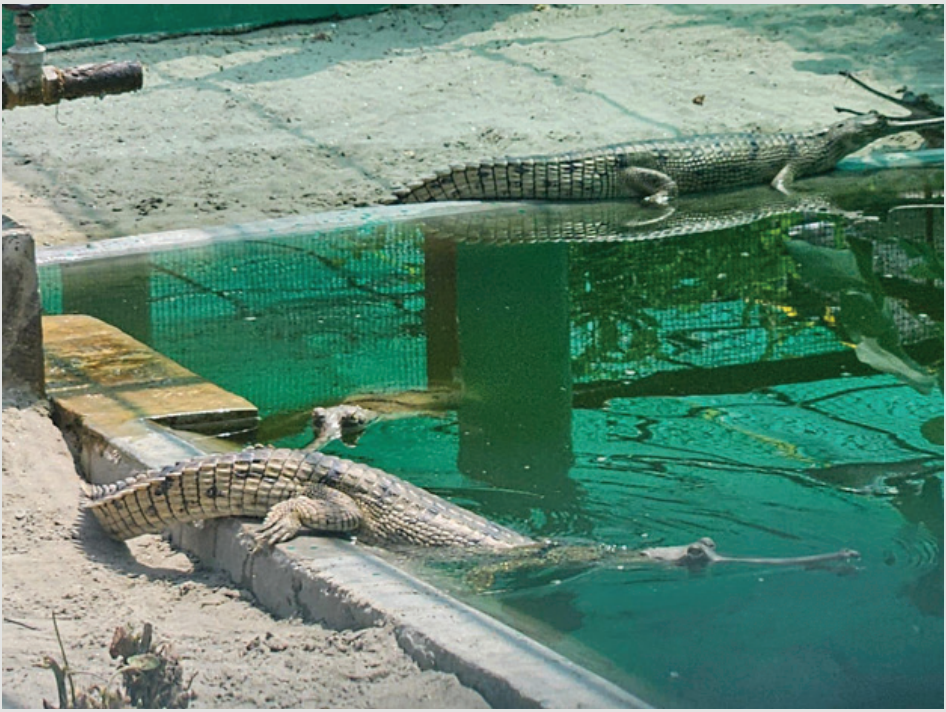


*Fig 10: Multiple gharials (Gavialis gangeticus) basking and swimming at the Kukrail Rehabilitation Centre, evidencing a thriving captive population sustaining this Critically Endangered species.*

- CIMAP institutional research on agro-technology, plant germplasm improvement, and essential-oil chemistry of medicinal and aromatic plants cultivated on Ganga Plain alluvial soils (CSIR–CIMAP, Annual Reports).

Collectively, this literature has established a robust regional understanding of Quaternary sedimentation, palaeosol development, river dynamics, palaeoclimatic variability and biodiversity conservation across the wider Ganga Plain (Singh, 1996; Tandon et al., 2008), providing the scientific foundation against which the Kukrail–CIMAP transect can be interpreted.



*Fig 11: Tissue culture racks at CSIR-CIMAP, Lucknow, sustaining large-scale in vitro propagation of medicinal and aromatic plant germplasm.*



*Fig 12: In vitro shoot cultures of medicinal plants at CSIR-CIMAP, Lucknow, demonstrating aseptic micropropagation.*



*Fig 13: Pilot-scale stainless steel bioreactor at CSIR-CIMAP, Lucknow, used for large-scale fermentation and bioprocessing of medicinal and aromatic plant-derived compounds.*

**Outstanding Issues and Research Gaps**

The Congress's focal theme, Quaternary Science as Societal Services, calls for research that explicitly links Quaternary archives to present-day societal and environmental challenges. Viewed against this theme and the scope of INQUA's four scientific commissions, the Kukrail–CIMAP transect highlights the following outstanding issues, which align directly with active INQUA session and commission priorities:

1. Stratigraphy and chronology (SACCOM) — the absence of a fine-resolution, independently dated stratigraphic and palynological framework specifically for the Kukrail river corridor, as distinct from broader regional Ganga Plain syntheses (cf. Srivastava et al., 2010; Tandon et al., 2008). Establishing a local chronological control (e.g. OSL/luminescence dating) would allow this urban floodplain to be correlated reliably with the wider Ganga Plain stratigraphic framework- a core SACCOM concern.

2. Terrestrial processes, deposits, and landscape history (TERPRO)- limited quantification of contemporary channel migration, overbank deposition, and terrace-riser soil/calcrete formation at Kukrail as an active analogue for the fluvial processes that built the regional Late Quaternary record. This represents an opportunity for TERPRO-aligned process-based geomorphological monitoring within a readily accessible urban field laboratory.

3. Palaeoclimate and palaeoenvironmental reconstruction (PALCOM) — a general scarcity of high-resolution, well-dated local palaeoenvironmental archives (pollen, phytolith, geochemical proxies) at the sub-regional scale, compared with coarser basin-wide syntheses (Gibling et al., 2005; Tandon et al., 2008). Targeted proxy work at Kukrail could sharpen understanding of Late Holocene monsoon variability in the Middle Ganga Plain, a priority area for PALCOM.

4. Humans, biosphere, and societal services (HABCOM) — under-documented linkage between CIMAP's agro-technological soil management and the Quaternary pedogenic history of the alluvial tract on which it sits (cf. Pal et al., 2009), and limited published genetic-diversity data on the captive gharial breeding stock and its long-term population viability (cf. Choudhury & de Silva, 2013; Stoeckle et al., various years). Both issues speak directly to HABCOM's mandate on human–biosphere interaction and the application of Quaternary science to conservation and resource management — core dimensions of the Congress's "societal services" theme.

5. Geohazards and environmental-impact assessment — the lack of an integrated environmental-impact assessment linking proposed eco-tourism infrastructure (e.g., night-safari development) to floodplain hydrology and habitat function. This gap is relevant to Congress sessions on geo-resources, land-use change, and the application of Quaternary science to environmental risk and policy.

6. Cross-disciplinary integration (multi-commission) — limited integration of geological and ecological datasets within a single analytical framework, despite their shared dependence on the same alluvial landscape history (Singh, 1996; Srivastava et al., 1998).The Kukrail–CIMAP transect is well suited to the kind of cross-commission, multidisciplinary session increasingly encouraged at INQUA congresses, bridging

SACCOM/TERPRO stratigraphic and geomorphological methods with PALCOM proxy reconstruction and HABCOM conservation and societal-impact framing.

7. Urban ecosystem resilience — a need for dedicated, INQUA-relevant studies of ecosystem resilience in urban and peri-urban Quaternary landscapes such as Kukrail, where conservation infrastructure must function alongside sustained urbanisation pressure — a theme of direct relevance to the Congress's call for research addressing food, water, environment, and shelter security under the societal-services framework.

The Kukrail–CIMAP transect is therefore well positioned to support future multidisciplinary investigation — combining sediment analysis, pollen and phytolith studies, geochemistry, geomorphological mapping, and ecological monitoring — and offers Congress delegates a tangible, accessible starting point for collaborative research proposals spanning SACCOM, PALCOM, TERPRO, and HABCOM, in direct service of the Congress's focal theme.

# Field Transect

**Route Overview**

The excursion follows a single, accessible urban-to-peri-urban transect designed to link the Congress venue directly with the two principal field sites:

Lucknow City (IGP / Congress venue) → Kukrail Reserve Forest → Gomti River influence zone (Kukrail riparian corridor) → CIMAP Campus → Return

This sequence allows delegates to traverse, in a single day, the stratigraphic and geomorphic transition from the older Bhangar surface (urban Lucknow, CIMAP) to the younger Khadar floodplain surface (Kukrail), while observing the corresponding shift in vegetation, conservation infrastructure, and applied plant science.




*Fig 14: Google Maps route illustrating the field trip itinerary connecting Kukrail Forest Picnic Spot, Kukrail Gharial Park, and CSIR-CIMAP, Lucknow — spanning ~9.2 km across the study sites.*

**Stop-wise Itinerary and Scientific Focus**

| Stop | Location | Observation Focus | Linked Scientific Theme | Approx. Duration |
|---|---|---|---|---|
| 1. | Departure- IGP/ Congress venue, Lucknow | Safety briefing, logistics overview | Congress orientation | - |
| 2. | Kukrail Reservea Forest main gate & nature trail | Forest stand structure, plantation history, soils of the Khadar surface | Biodiversity conservation; Quaternary surface mapping (Bhangar–Khadar) | 60 Min |
| 3. | Kukrail Gharial Rehabilitation Centre | Ex-situ breeding ponds, hatchery, interpretation centre/museum | Conservation biology; HABCOM- aligned human – biosphere interaction | 60-75 Min |
| 4. | Kukrail river bank section (Gomti influence zone) | Channel morphology, bank sediments, riparian vegetation | Hydrology, fluvial geomorphology, Quaternary depositional processes | 30-45 Min |
| 5. | En-route lunch / rest stop | - | - | - |
| 6. | CIMAP campus, Lucknow | Institute overview, germplasm fields, essential-oil laboratories | Plant science innovation; applied biodiversity and societal services | 90 min |
| 7. | Return to IGP / Congress venue | Synthesis and wrap-up discussion | Integration of geology–ecology–society themes | - |

# Location Description

**Kukrail Reserve Forest and Gharial Rehabilitation Centre:**

Kukrail Reserve Forest lies within the low-relief floodplain of the Kukrail River (~27 km), a tributary of the Gomti River, representing the Khadar floodplain–Bhangar terrace transition. The sediments comprise fine overbank silts and clays with sandy channel fills, deposited in a low-gradient meandering system. Terrace soils show early pedogenic features such as mottling and calcareous nodules. The deposits are regionally correlated to the Late Pleistocene–Holocene, while future $^{14}C$ and OSL dating and geochemical studies can refine the chronology and environmental history.

**CIMAP Campus:**

The CIMAP campus is located on a gently undulating Bhangar (older alluvial) surface characterized by very low relief and well-drained terrain. The area is developed on older alluvial deposits comprising predominantly loam to silty-loam soils, which are more oxidized and structurally mature compared to the younger floodplain sediments of Kukrail. These mature alluvial soils represent prolonged landscape stability and pedogenic evolution, providing suitable conditions for vegetation growth and agricultural applications. Although no specific chronological or geochemical sampling programme is planned during the excursion, the site demonstrates the relationship between older alluvial landscapes, soil development, and their role in supporting modern agro-biotechnology and medicinal plant research.

# Geoheritage, UNESCO Heritage, Archaeological Sites, and Culture

**Status of the Excursion Sites**

Kukrail Reserve Forest and CIMAP are significant for this excursion due to their ecological, biogeomorphic, and applied scientific value. They demonstrate human adaptation to alluvial landscapes, conservation of urban biodiversity, and the integration of scientific research with societal needs, reflecting the broader INQUA theme of "societal services" and sustainable environmental management.

**The Geoheritage–Biodiversity–Culture Continuum**

Taken together with the wider Lucknow urban transect, the excursion illustrates what may be termed a Geoheritage–biodiversity–culture continuum: a single Quaternary alluvial landscape that simultaneously supports a working geomorphic and ecological system (Kukrail), an applied scientific institution built on the same alluvial soils (CIMAP), and a historic urban fabric shaped over centuries by the same river plain. This continuum offers delegates a tangible example of how natural heritage, geological landscape, and cultural history are interwoven across the Ganga Plain.

**Nearby Heritage and Archaeological Sites**

Lucknow hosts substantial built heritage of direct interest to visiting delegates and accompanying persons, located within the same urban transect:

- **Bara Imambara and Chhota Imambara** — eighteenth-century Nawabi-era monuments, notable for the Bhul-bhulaiya labyrinth and the Asfi Mosque.
- **Rumi Darwaza** — an iconic Nawabi-era gateway in central Lucknow.

- **The Residency (British Residency ruins)** — a protected archaeological and historical site associated with the 1857 Uprising.
- **Dr. Babasaheb Ambedkar Memorial Park and Janeshwar Mishra Park** — large landscaped public parks reflecting modern urban heritage planning.
- **Hazratganj and Chowk bazars** — centres of Awadhi culture, cuisine, and the Lucknowi chikankari embroidery craft.

**Recommendation for Delegates**

Delegates wishing to extend their visit are encouraged to combine this excursion with a short heritage walk through old Lucknow. Doing so reinforces the trip's central message: the same Quaternary alluvial landscape examined at Kukrail and CIMAP has, over millennia, also shaped the cultural and architectural heritage of the city built upon it.

# Local Convenience

Lucknow offers good general visitor infrastructure, including airport and railway connectivity, a range of hotels and accommodation, well-equipped medical facilities, local markets, and banking and communication services. Emergency assistance for the field day is available through local authorities and the Congress coordination team.

**Medical / Hospitals**

- King George's Medical University (KGMU), Lucknow — major government tertiary hospital with 24-hour emergency services.
- Sanjay Gandhi Postgraduate Institute of Medical Sciences (SGPGIMS), Raebareli Road, Lucknow.
- Several private multi-speciality hospitals operate in the Gomti Nagar / Indira Nagar area near Kukrail; the field-trip leader will carry a list of the nearest facility to each stop, along with basic first-aid supplies.

**Lost or Stolen Passport / Documents**

- Report immediately to the nearest police station and obtain a First Information Report (FIR) / police complaint copy.
- Contact your country's Embassy/Consulate in New Delhi (the nearest diplomatic mission for most countries) for an emergency travel document; Lucknow does not host most foreign consulates.
- Inform the Congress Organising Secretariat (inqua.india@bsip.res.in) and the field-trip leader, who can assist with local liaison.

- Keep photocopies/digital scans of your passport and visa separate from the originals before travelling.

**Bazars and Amenities**

- Hazratganj — central shopping district with cafes, bookstores, and souvenir shops.
- Chowk and Aminabad — traditional bazars known for chikankari embroidery, perfumes (attar), and Awadhi food, with abundant options for both vegetarian and non-vegetarian dining (including the region's well-known kebabs and biryani, alongside a wide range of vegetarian thalis and street food).
- ATMs and currency-exchange counters are available at the Congress venue (IGP) and in Hazratganj/Gomti Nagar; carrying a small amount of Indian Rupees in cash is advisable for the field day, as rural/forest stops may have no card facilities.
- Mobile network coverage is generally good throughout the transect, though signal may weaken briefly within forest-interior sections.

# Conclusions

The Kukrail–CIMAP excursion offers delegates a rare, single-day window into how Quaternary alluvial landscapes continue to shape both biodiversity conservation and applied science in contemporary India. Kukrail's gharial rehabilitation programme- an ex-situ conservation effort embedded in a living floodplain ecosystem sits in direct dialogue with CIMAP's agro-technological use of the same alluvial soils, together embodying the Congress's focal theme: "Quaternary Science as Societal Services".

This transect is more than a field stop; it is a call to action. Open questions on floodplain chronology, gharial conservation genetics, and eco-tourism impact assessment span INQUA's SACCOM, PALCOM, TERPRO, and HABCOM commissions alike - an invitation for delegates to carry this transect's questions back into their own research and collaborations.

# Acknowledgements

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The convenors also thank all participating institutions, field coordinators, contributing authors, and reviewers of this field guide for their collective effort in bringing this excursion to the international Quaternary science community.

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BUDGET REQUIRED TO CONDUCT THE PROPOSED FIELD TRIP: -

| Heads | Estimated Cost (INR) |
|---|---|
| AC Deluxe Bus Transportation (1 day) | 30,000 |
| Working Lunch, Tea & Refreshments (40 participants) | 40,000 |
| Field Kit (Guidebook, Name Tag, Notepad, Pen, Information Sheet) | 20,000 |
| Drinking Water & Packed Refreshments | 8,000 |
| Entry Fees/Site Facilitation/Permissions | 10,000 |
| Honorarium for Resource Persons & Field Experts | 15,000 |
| Photography & Documentation | 8,000 |
| First Aid & Emergency Support | 5,000 |
| Miscellaneous & Contingency | 14,000 |
| **Total Estimated Budget** | **₹1,50,000** |

# Annexure

## Field Excursion Guidelines: Do's and Don'ts

To ensure the safety of all participants and to promote responsible scientific field practices, all participants are requested to adhere to the following guidelines throughout the field excursions.

Keep a valid passport (for international participants) or a government-issued photo ID (for Indian participants) with you at all times during the field excursion.

| Do's | Don'ts |
|---|---|
| 1. Follow the instructions of the excursion leaders, coordinators, and local authorities at all times. | 1. Do not collect rocks, fossils, archaeological artefacts, biological specimens, or any other materials without prior authorization. |
| 2. Remain with the group and inform the excursion leader before leaving the designated route. | 2. Do not damage, deface, or remove material from geological outcrops, caves, monuments, heritage structures, or other natural features. |
| 3. Wear appropriate field attire, including sturdy closed-toe footwear, full-length trousers, a hat or cap, and weather-appropriate clothing. | 3. Do not wander alone or separate from the excursion group without informing the field leaders. |
| 4. Carry sufficient drinking water, personal medications, sunscreen, insect repellent, and other essential field supplies. | 4. Do not climb unstable slopes, cliffs, rock formations, or enter hazardous areas unless specifically instructed or supervised. |
| 5. Keep a valid photo identification and your excursion registration details with you during travel. | 5. Do not swim or enter rivers, lakes, lagoons, or coastal waters unless expressly authorized by the excursion leaders. |
| 6. Respect local customs, religious sites, cultural heritage, and private property. | 6. Do not consume alcohol, recreational drugs, or engage in unsafe or irresponsible behaviour during the excursion. |
| 7. Follow the Leave No Trace principles by carrying back all waste and helping to keep field sites clean. | 7. Do not operate drones or other restricted equipment without obtaining the necessary permissions. |
| 8. Use designated trails and approved observation areas to minimise environmental disturbance. | 8. Do not photograph restricted installations, sensitive locations, or local residents without prior permission. |
| 9. Observe geological, ecological, archaeological, and cultural features carefully without causing any damage. | |

10. Record field observations systematically and collect samples only with prior permission from the excursion leaders and the relevant authorities.

11. Exercise caution near cliffs, riverbanks, caves, unstable slopes, road cuts, and other potentially hazardous terrain.

12. Respect wildlife by maintaining a safe distance from animals, birds, reptiles, insects, and their habitats.

13. Immediately report any illness, injury, emergency, or hazardous situation to the excursion organizers.

14. Be prepared for changing weather conditions and comply with all safety advisories issued by the excursion leaders.

9. Do not create excessive noise or disturb local communities, religious activities, wildlife, or natural habitats.

10. Do not leave valuables unattended or rely solely on mobile phone connectivity in remote areas.

11. Do not undertake any activity that may compromise your safety, the safety of fellow participants, or the conservation of the area's geological, ecological, archaeological, or cultural heritage.

## Disclaimer

Participation in the field excursions is entirely at the participant's own risk. While the Organising Committee and excursion leaders will make every reasonable effort to ensure participant safety and provide appropriate guidance, they shall not be held responsible for any personal injury, illness, loss of personal belongings, property damage, delays, or unforeseen incidents arising during travel or field activities. Participants are expected to act responsibly, follow all instructions issued by the excursion leaders, and comply with applicable local laws and regulations throughout the excursion.

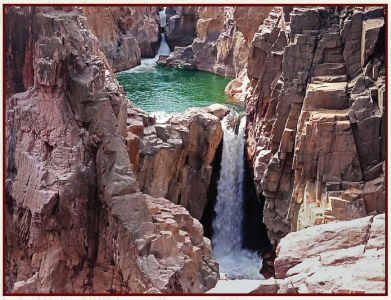












Scan for
Field Guide Book


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